SIXTY-SEVENTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CV. NUMBER 20. ★ NEW YORK, NOVEMBER 11, 1911 ★ [10 CENTS A COPY $3.00 A YEAR

Relief map of the antarctic regions, showing routes of various expeditions in quest of the South Pole.

ANTARCTIC EXPEDITIONS, PAST AND PRESENT.—**[See page 424.]**

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, NOVEMBER 11, 1911

Published by Munn & Co., Incorporated. Charles Allen Munn, President; Frederick Converse Beach, Secretary and Treasurer; all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter

Copyright 1911 by Munn & Co., Inc.

Subscription Rates

Subscription one year $5.00

Postage prepaid in United States and possessions, Mexico, Cuba, and Panama

Subscriptions for Foreign Countries, one year, postage prepaid, 4.50
Subscriptions for Canada, one year, postage prepaid, ... 5.75

The Scientific American Publications

Scientific American (established 1845) . . . . . per year, $3.00
Scientific American Supplement (established 1876) . " " 5.00
American Homes and Gardens . . . . . " " 5.00
The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.

Remit by postal or express money order, bank draft or check.

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Evolution and Geographical Distribution

WE generally think of the survival of the fittest as a principle which operates *in time*, bringing about those changes in biological species which are implied in the term "evolution." But the same natural selection which *in time* causes a closer adaptation of the organism to its environment is also potent in regulating the distribution of the several types and species *in space*. For, as climatic and other conditions vary according to the locality, the "selective influences" at work at each point of our globe differ correspondingly from place to place, and the material selected, the surviving type, thus becomes a function of geographical position. The white man of the temperate zones is ill adapted for the torrid climate of central Africa, where nevertheless thrives, physically at least, the dusky native. The latter, again, when transplanted to our climate, proves less fitted for the battle of life than the white race, as is shown by his greater death rate and liability to certain diseases.

But selection does not operate through death rates alone. Let us make a seeming digression, borrowing an example from physical chemistry. The chemist separates the more volatile constituents from a mixture by establishing local differences in temperature in a suitably constructed system: the hot portion is called a retort, the cold a receiver. The mixture is heated in the retort, and presently the volatile vapors pass over into the receiver, where they condense to liquid. We need stretch the meaning of the term very little to say that the volatile liquid is not "adapted" to the conditions of high temperature which prevail in the retort, and is thus "weeded out" and converted into vapor. In the cooled receiver the conditions are different. Here the liquid is stable, and can subsist indefinitely. This is not unlike what happens in the living world, and with the human race. In the course of time the population of Europe has increased until, for very crowding, the struggle for existence has become much intensified, however much it may have changed in character. The opening up of a new world across the seas has furnished a vent whereby some of the surplus has been able to escape to a less populous region. And just as in the still of the chemist, the substance which passes over into the receiver is not the same in composition as the material originally introduced into the retort, but contains a greater percentage of the more volatile constituents, so we may naturally look for a more or less marked difference between the overflow from the old world which has settled on this continent, and the residue in the home countries. We should, in fact, expect that the settlers, and presumably through hereditary influence their descendants also, would represent the more "enterprising" element of the original population. And indeed, a strong spirit of enterprise is by common consent one of the most marked characteristics of the American nation. Somewhat less obvious, though none the less interesting, is a similar effect which has been observed in the old world. De Candolle in his "History of Science and Savants," illustrates by a number of very remarkable examples that the refugees, who, for holding fast to their personal convictions in the face of popular opinion, were expelled from their home countries during the troublous times of the sixteenth to the eighteenth century, have, together with their descendants, contributed over four times the normal share to the world's army of scientific men, thus bringing a rich reward to the countries which offered them shelter. The practically absolute sterility of Spain in the field of science has been attributed to the influence of the terrible Spanish Inquisition, which very effectually stifled all independent thought, and killed off every individual in whom the divine thirst for truth was clamoring to be satisfied.

It must ever be a cause of universal regret that some members of that same organization which did so much to cultivate art and learning in the middle ages should, in mistaken zeal, and with the crudity characteristic of their epoch, have dealt so little sympathy to some of those who helped to lay the foundations of modern science.

Perhaps the most extreme case of the segregation of a special type of individuals by a process of "distillation" into a locality widely differing in character from the abode of the main body of the species, is presented to us when we look at a map of the polar regions, such as appears elsewhere in this issue. Here we may follow the tracks of intrepid wanderers, who braved the hardships and perils of that barren waste of ice and snow which guards the earth's poles from the approach of inquisitive man. None but the most venturesome and skilled explorers have found their way into this pale; here is selection indeed, and every man in this territory a hero.

The Toll of Aviation: A Remedy

THE passing the other day of the century mark in the number of lives lost in aviation calls to mind the pioneers whose lives were sacrificed *needlessly* in the development of this great science. The last of these to lose his life as a result of his personal experiments was Prof. John J. Montgomery, of Santa Clara College, Cal., who was killed the 31st day of October, while trying out one of his gliders.

It is a peculiar coincidence that Prof. Montgomery, who had built and operated successful gliders before the Wrights began their experiments, and who, by releasing a following surface monoplane glider from a balloon in 1905, had enabled Daniel Maloney, the aeronaut, to make the first motorless flights of a quarter of an hour's duration, should fall to his death only a few days after Orville Wright had achieved success along these lines and had risen from the ground and remained aloft 9¾ minutes without the use of any motive power save gravity and the wind. A parallel coincidence was seen in the death of Prof. Langley just after the Wrights achieved in December, 1903, what he had striven so hard and earnestly to accomplish.

When we look back over the list of pioneers who have gone to their deaths as the result of their unconquerable desire to fly *themselves*, we deplore this unnecessary sacrifice and wonder how much more advanced we would be to-day if we still had Lilienthal, Selfridge, and Nieuport. Perchance the great German would have found ere this a way to utilize the intangible ascending currents of air as Orville Wright has just utilized a 50-mile gale and thus have set us all soaring in bird-like fashion, every man on his own home-made monoplane. Oh, that some means were found of communicating with the dead, that they might transmit to us the secrets and vast knowledge they have taken with them! How much faster the world would move forward in all the sciences and arts!

But since such is not the case, it behooves those talented men who still remain not to jeopardize their lives by taking unnecessary risks. The accident that snatched away Lieut. Selfridge came within a hair's breadth of claiming Orville Wright also, while in his recent glider experiments he has had some rather close calls. The death of Prof. Montgomery so soon after, shows that danger lurks even in a motorless machine; while Glenn Curtiss should remember Manley's miraculous escape from drowning when the Langley aeroplane was launched from a house-boat, and should not personally take even seemingly slight risks with his hydro-aeroplane.

The "Father of Aviation" in America, the late much-loved and esteemed Octave Chanute, followed the proper course when he secured alert and active young men such as Avery and Herring to do the real experimenting. The same was true of Prof. Langley, who was fortunate in securing the services of so eminent a young engineer as Charles M. Manley—a man capable of constructing both motors and aeroplanes, and of flying them when built.

If Edouard Nieuport had not dared to demonstrate personally for some officers his marvelous monoplane in a treacherous, gusty wind, he might again have produced a winner of the international speed race. The lamented Capt. Ferber is another pioneer who could not resist indulgence in the new, fascinating science. Had he studied it by proxy as did his fellow-countryman, Chanute, the aviation world would no doubt have had the benefit of his active brain for many years longer.

The Food Value of Bread

ALTHOUGH mankind has made use of bread in some form or other for several thousand years, there still remains much unknown about the food value and about the relation to digestion of this universal staff of life. An English study of the subject has just been completed, by a committee of the Local Government Board. This committee made use of much of the work done by experts of the U. S. Department of Agriculture.

The old controversy between the advocates of roller-mill flour and the defenders of stone-mill flour need never again be revived, in view of the results obtained by a scientific analysis of meals produced by the two processes. Not only do the roller-mill flours show a larger percentage of available nutrients, but the best grades of wheat—the so-called "hard wheats"—cannot be utilized at all in the old-fashioned stone mill; and the flours having the best "baking qualities" are produced by the roller mills. Roller-mill flours are also the whitest flours, which appeals to many on the esthetic side.

Notwithstanding the enthusiasm of many apostles of whole-wheat bread, the findings of the commission will rob them of some of their converts. It is found that the presence in food of bran—the outer coverings of the wheat grain—may be advantageous under special circumstances; but that in general it is an undesirable element in bread. Not only is the bran itself indigestible, but it interferes with the digestion of other nutrient factors in the food. For example, in one set of experiments it appeared that when milk was taken with whole-wheat bread three per cent less of the milk was digested than when it was taken alone, or with white bread.

The most important point, however, is not the manner in which the flour is manufactured, but the character of the wheat. That is, there is more difference between roller-mill, or stone-mill, flours from different kinds of wheat, than there is between the two different preparations from the same grain. It is at the same time in the direction of producing improved strains of wheat that the most progress has been made in recent years.

Advocates of the virtues of bran in food often recommend the mixing of a small quantity of whole-wheat flour with the white flour, in order to increase the percentage of mineral matter. The gain in salts to be obtained in this manner is, however, so slight, that a growing child would have to eat an excessive quantity of bread to derive any appreciable benefit from this method. With the mixed diet that is all but universal in civilized countries, we may well depend upon other parts of the ration to supply the additional mineral matter required by a growing child.

Contrary to very common belief, this report declares that the different effects upon the teeth produced by different kinds of bread, are altogether negligible. The possibility for standardizing flour is considered to be very slight at the present time, especially on account of the different kinds of wheat used in milling. Still, the differences between the various kinds of wheat flour on the market are not of serious importance.

That whole-wheat flours may contain substances of value—quite apart from their influence upon digestion—is believed by the committee to be a possibility worth considering; and they recommend scientific investigation upon this point as well as upon several other problems that arose in the course of the inquiry.

A New Use for Cactus

A CONSULAR report from Montevideo suggests that the people of the southwestern United States, where cactus is abundant, and often a nuisance, might follow the example of the Uruguayans and utilize this plant in making whitewash. When traveling through the rural districts of Uruguay one's attention is attracted by the fine white color of the farm buildings, even during the wet season. The whitewash is made from the sliced leaves of the common cactus, macerated in water for 24 hours. To the creamy solution thus produced lime is added. When applied to any surface, a durable pearly white appearance is produced.

Hugo de Vries

Famous for his Mutation Theory of Descent

By D. T. MacDougal, Ph.D., LL.D., Director Department of Botanical Research, Carnegie Institution of Washington

ALL students of the growth and other physical activities of plants during the past twenty years have found that any consideration of the manner by which a plant retains its rigidity, plumpness or firmness, or executes movements, inevitably brings one to follow the experimental studies of Hugo de Vries, who published his first paper upon the mechanical causes of turgidity as early as 1877. A plant cell may be roughly likened to a sac of living matter which holds water in its interior under a pressure which may amount to as much as 25 or 30 atmospheres, and this is possible only by reason of the impermeability of the outer wall, which is capable of undergoing a wide range of variation as to its physical properties. Outside of the living membrane of a cell is another of cellulose, and this is fully permeable. The differential behavior of the living and non-living membranes when the cell is placed in solutions of osmotically active substances, such as sugar and potassium nitrate, form the basis of the phenomena of plasmolysis and afford a clue to the conditions of turgescence within the cell. The systematic use of solutions in producing plasmolysis, and a rational interpretation of the facts, were first given by De Vries in 1877.

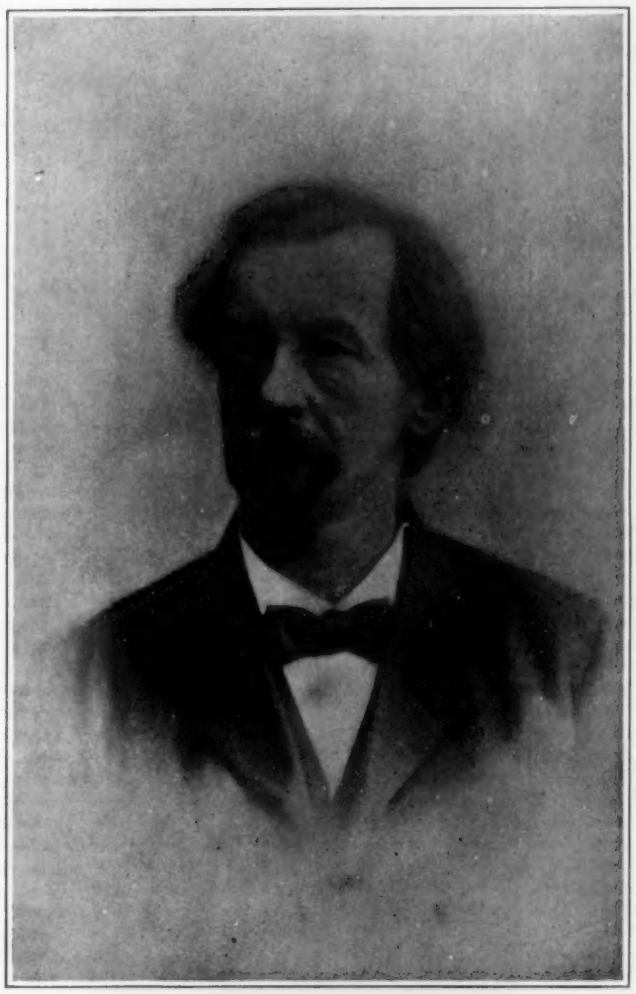
These results have their direct and immediate importance chiefly in plant physiology, but their wider application in the establishment of the isotonic co-efficients of various substances, together with the experiments of Pfeffer, another botanist, in osmosis, form the basis of the electrolytic dissociation theory of Arrhenius, as well as the law of van't Hoff that "dilute solutions obey the same law as gases," both conceptions of the greatest importance in the physics and chemistry of to-day.

With achievements of such magnitude to his credit within eight years after receiving his doctor's degree from the University of Leyden, and at the age of 29 (born in 1848, at Haarlem, Holland), the attainment of a foremost place among the botanists of the world, and the earned recognition as the greatest evolutionist after Darwin, seem a logical and natural development of a master mind in biological science.

His developing powers of research can be shown to be coincident with a movement in all natural sciences which occurred late in the last century by which attention was directed more and more to the transformations of energy in general and to the activities, functions, qualities and capacities of organisms in particular. Habits and performance were recognized as biologically more important than form or even structure. It was in consonance with this trend of science that De Vries, who had long been concerned with variability in organisms, should formulate a prothesis as to the mechanism of heredity, which should put forward a physiological rather than a morphological explanation of heredity, which was done with the presentation of his Pangenesis in 1889.

This splendid contribution was not solely an abstract product of the study, but represented the working hypothesis of a brilliant experimentalist intent on visualizing the mechanism of heredity and providing a working hypothesis by which a rational interpretation of the continuation of qualities from generation to generation through germ-cells could be made. Coincidently with its appearance, De Vries began to publish the results of his investigations upon variability, and mutations in plants, upon which he finally erected his Mutation Theory of Descent, in final and formal shape, about the beginning of this new century.

The extensive experimental cultures organized by deVries in the Botanical Garden of Amsterdam, yielded results of importance with regard to the inheritance of unusual characters in plants, such as torsions or twistings of stems, fascinations, bandings or cristations, as well as statistics upon the curves of variation of single characters. It was in these studies in the behavior of pairs in balanced characters in crossing, that De Vries re-discovered independently the Mendelian principles of alternative inheritance, which had remained unnoticed for a half century. The simplest illustration of Mendelianism is to be seen when a red and a white variety of the same species are crossed, the color qualities being considered as "balanced" or paired. The seeds from such a cross give rise to a progeny of plants all of which bear red flowers, that color being dominant over white. The seeds produced by this first generation of red-flowered individuals, however, generally produce a progeny, three-fourths of which are red-flowered while the remainder bear white flowers. Similar behavior is exhibited by many other qualities, although the division of the progeny does not always follow the simple formula noted. In addition, he brought to light many important things concerning xenia, atavism, derivation of economic races of plants, and effects of selection, of prime interest to a wide range of scientists, and to horticulturists, agriculturists and plant breeders. As may be seen, however, these results are to be considered as no more than by-products of his cultures, since much more important things were the center of attention. Early in the eighties, a series of observations were begun in which the successive generations of about a hundred species of plants were followed in order to ascertain exactly what resemblances might be found between parent and progeny in guarded and pure lines of descent. The behavior of one plant, a large evening primrose, *Oenothera Lamarckiana*, which had been introduced into Europe in the seventeenth century, offered phenomena of unusual interest, since it was seen to give rise to several sports, or salts, or mutants which differed distinctly from the ancestral form, and these new forms bore distinct qualities which were maintained in direct descent. It was upon such facts that De Vries founded his theory of the origin of new species by the sudden origination or disappearance of qualities in organisms.



PROF. HUGO DE VRIES

The biological public received these generalizations with indifference. In addition to the inertia of old ideas, some curious nationalistic prejudices found expression. As many English naturalists and scholars in other branches fought the idea of natural selection, when presented by Darwin, with vicious unfairness, so now a similar element was responsible for much criticism, resentful of anything which might modify the attitude of the world toward Darwinism, an attitude still recognizable in current publications. The writer of this note had the pleasure of presenting a summary of the mutation idea of evolution, with an account of the experimentation upon which it was based, to a meeting of botanists in the New York Botanical Garden in 1902, at which time some cultures of the *Oenotheras* from seeds furnished by Prof. de Vries were begun, which, it is believed, constitute the first demonstrations of the main thesis outside of the Botanical Garden at Amsterdam. These experiments in New York confirmed the facts obtained in Amsterdam in every important particular, and their publication in 1903, found a rapidly growing interest in the subject in America. Prof. de Vries was consequently invited to give a series of lectures in various institutions from the Atlantic to the Pacific, receiving a full measure of recognition in academic honors, which have been followed by similar expressions of appreciation from learned bodies all over the world.

A full, non-technical exposition of the mutation theory was given at the University of California in the summer of 1904, and to the writer fell the pleasure of putting these lectures into book form under the title of "Species and Varieties: Their Origin by Mutation." This book came to its second edition within a few months, being styled the "most notable scientific book of the year" by a competent reviewer, a statement apparently justified by the fact that it has since been translated into Dutch, French, and German.

A large number of the investigations which were begun as a result of his first visit to America, profited by his second visit in 1905, and he has had the exceptional opportunity of seeing his observations repeated under the widest variety of climatic and other environmental conditions. These confirm the significance of the facts upon which the mutation theory was founded. In addition to the sports or mutants of the evening primroses which formed such an important part of the original evidence upon the subject, similar phenomena have been observed in many other seed-plants and among the lower forms including the bacteria. The origination of new races or species in animals is not so easily observed, but still authenticated instances are accumulating. That new qualities suddenly appear in lines of descent is no longer a question, but it is still to be determined how large a part such action plays in the general scheme of evolutionary development.

Any discussion of Prof. de Vries's work raises the question at once as to the relation of the new ideas he has formulated to the older conceptions of Darwin. One theological author has gone so far wrong as to write "The death-bed of Darwinism" by a misapprehension of the meaning of mutation. Darwin would have evolutionary progress by the selection and survival of infinitely minute divergences through thousands or hundreds of thousands of generations, arriving finally at types widely different from the original. De Vries holds that the organism fluctuates steadily about its average or norm, from which it does not depart beyond a certain limit, but the line of descent may, at any time, include individuals possessing new qualities not shown in any degree by the parental strain. Selection decides between these forms and those previously existing, the fittest of the types surviving. Instead of supplanting the theory of natural selection, the mutation conception has the actual force of coming to its support at a time when many of its generalizations were being recognized as notably inadequate to the full interpretation of known facts. The mutation theory defines more accurately, the manner in which selection may act, in addition to offering an explanation of the manner in which new capacities or qualities may arise.

Although now in his sixty-third year, and nearing the age of academic retirement, Prof. de Vries is deeply engaged in experimentation, and the cultures in the Botanical Garden at Amsterdam may yet yield results of a theoretical and practical importance in evolutionary science, scarcely less than that of pangenesis and mutation.

Antarctic Expeditions, Past and Present

Some Heroes of Exploration

A BARREN continent, far from human habitation, utterly desolate, snow-clad, enfenced in forbidding barriers of ice. Yet around it circle and twine in sinuous paths the tracks of many gallant explorers, who for the last one hundred and forty years have strained every nerve to conquer those inhospitable shores. What priceless treasure, what thing so coveted of men does this lonely waste harbor, that they should brave the perils of famine and an icy death in their quest? No ordinary material reward is that they seek: theirs is an ideal goal; the thirst for knowledge, the spirit of scientific exploration, and no doubt the love of a manly fight against desperate odds, these are some of the motives that fire them. And it is for us, who stay at home in safety and comfort, reading the history of their doings, to catch some faint spark of inspiration from the exploits of those gallant men and bold, as we also reap the material benefits which flow from their scientific labors.

The first antarctic expedition falls into that period which is so peculiarly replete with important events, both in the world of politics and in the realm of science. We read in a leaflet issued by the American Museum of Natural History, that in 1772, Capt. Cook, of the British Navy, was commissioned by the Admiralty to command two vessels to examine into the question of the existence of a great southern continent. He sailed from Plymouth in July, reached Cape Town in October, and entered the area shown in our front page illustration near the 20th meridian of east longitude. The first part of his course will be seen putting forth a nose toward Enderby Land, which appears near the "horizon line" and to the right from the center. Cook next proceeded along an easterly course, then turned abruptly south, and on January 17th, 1773, was the first person to cross the antarctic circle. Cook continued his travels, the line of which will be seen again and again in different portions of the accompanying map, though part of his course lies outside the area covered therein. In January, 1774, he reached his farthest southerly point, 71 degrees 10 minutes, near 110 degrees west, a record which was not broken for half a century. It is noteworthy that Cook, the first successful antarctic explorer, not only completed the circumnavigation of the antarctic, but proved the non-existence of any antarctic land mass extending north of the antarctic circle.

The next South Pole expedition of any importance was carried out under the patronage of Alexander II. of Russia, who appointed Bellingshausen to the command. This explorer sailed in January, 1820, with two vessels. His course also will be found sketched on the accompanying map. He crossed the antarctic circle some six times, and discovered Peter Island, the most southerly land then known. He did not, however, go quite as far south as Cook, but only reached 69 degrees 52 minutes.

In 1823, an Englishman named James Weddell, forced two small sealing vessels southward through the sea which bears his name, to 74 degrees 15 minutes south, a point 214 nautical miles nearer the pole than Cook's farthest travel, thus breaking the record that had stood for nearly fifty years. Weddell's course will be seen on the map near the horizon a little to the left of the center.

Enderby Land, to which we referred in indicating the position of Cook's course on the map, was discovered in 1831 by Biscoe, a British sealer, exploring under commission from the merchant firm of Messrs. Enderby. The course of Biscoe will be found on the map, forming a loop thrown over the antarctic continent.

An expedition sent out by France in 1837, under Commander d'Urville, deserves mention as being the last French south pole expedition until recent times.

In 1839, Lieut. Charles Wilkes, at the head of the United States exploring expedition, with a squadron of six vessels poorly equipped and poorly adapted for polar work, entered the south polar regions from Tierra del Fuego. His course will be seen on the accompanying map, approaching the antarctic continent near the center of the map, and following the coast line westward (to the right). In his journey through what is known as Wilkes Land, he took a course more southerly than any previous explorer known to him had traveled in this region.

James Clarke Ross, a nephew of Sir John Ross, the arctic explorer, and one who had several years of arctic experience, left Tasmania in 1840 in command of the "Erebus" and "Terror." The primary object of the expedition was to make certain magnetic explorations in the extreme south. In less than five months Ross returned to report the extraordinary results of his expedition. His course will be seen indicated by a tortuous white line tangled over the Ross sea.

Fully informed concerning the discoveries of Wilkes, he determined to seek high altitudes to the east of the Balleny Islands, and with little difficulty sailed into a new sea and discovered land extending from Cape Adare to the volcanoes of Erebus and Terror, 77 degrees south, a distance north and south of approximately four hundred miles. He thus reached a point considerably farther south than any attained by previous explorers. He finally reached England in September, 1843, having been absent for more than four years.

From the *Illustrated London News.*

Capt. R. F. Scott, leader of a British antarctic expedition at present under way. Mount Erebus in the background.

From *Die Umschau.*

The "Deutschland" of the German antarctic expedition.

In 1874 the first steamship, the British vessel "Challenger," entered the antarctic. It was also the first to be equipped with adequate sounding and dredging apparatus. As a result of the "Challenger's" investigations the existence of an antarctic continent was proved, and the fact that a wealth of animal life covered the floor of the south polar seas was well established. The course of this expedition under the command of G. S. Nares appears on the map near the upper right-hand corner.

During the last quarter of the nineteenth century, with the waning of the whaling industry in the north, and the report of the existence of large numbers of whales in the south, the small steam whalers of Scotland and Scandinavia made several expeditions into the antarctic. Among these was the "Jason," commanded by Capt. Larsen, whose course appears near the horizon to the left of the center of our map. Larsen discovered the first antarctic fossils, which proved that at least part of this region is not volcanic.

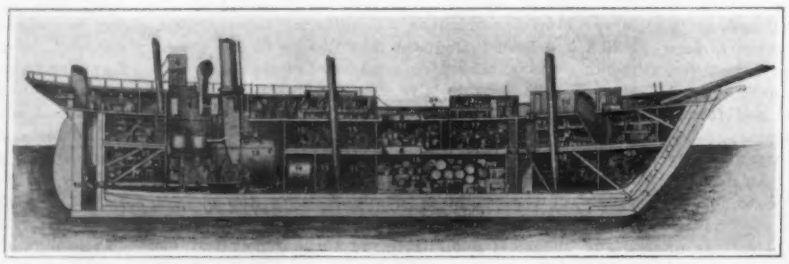
During the years from 1902 to 1904, Capt. R. F. Scott, commanding the "Discovery," a well equipped vessel manned by British navy officers and bearing a scientific staff of well qualified men directed a south polar expedition in which among others Shackleton took part. On November 2nd 1902, Scott, Shackleton, and Wilson began their heroic sledge journey over the polar ice to the south, a distance of 380 miles from their ship. They planted the British flag at 82 degrees 17 minutes south. The following winter was spent in the antarctic under conditions of intense cold, the thermometer frequently registering fifty degrees below zero and even reaching 68 degrees. It appeared at one time as if the "Discovery" must be abandoned, and the crew return on one of the relief ships that had been sent after them. But on February 16th, 1904, she was released from the ice and sailed for home. Scott's course will be seen indicated, extending roughly along the median north-south line on our map.

A Scotch expedition explored the south polar regions during 1903-1904, and among other things discovered Coats Land. The commander was W. S. Bruce, and his course appears right in the center of the horizon in our illustration.

We come now to the last and most successful of all the south polar expeditions. Early in 1908 Lieut. Shackleton on board the "Nimrod," with a party of about fifteen men, dogs, Siberian ponies, a motor car and other equipment, entered the antarctic regions near the 180th meridian. Passing through Ross Sea and along the edge of the great ice barrier they almost reached King Edward VII. Land but found further progress in that direction blocked by impenetrable pack-ice. They then proceeded to Cape Royds near the volcano, Mount Erebus. Here the "Nimrod" left them and went north, to return the following spring. Relatively elaborate winter quarters were established at Cape Royds in a specially designed hut made of cork. In March, 1908, a party of six ascended Mount Erebus to its summit, 13,500 feet above sea level.

On October 5th, 1908, a party of five started on its journey to the South Magnetic Pole, which was reached on January 16th, 1909. The position of the magnetic pole was determined to be 72 degrees 25 minutes south, 155 degrees 16 minutes east. The south point of the compass always turns toward this point. Therefore, between the South Magnetic Pole and the South Geographic Pole the south point of the compass is directed due north. This party, returning to the coast February 3rd, was picked up by the "Nimrod" and taken to Cape Royds.

On October 29th, 1908, Shackleton and three others—with a supporting party of five, which turned back November 7th—set out for the South Geographic Pole. They followed, roughly, the 168th meridian east until in late November they



From *Die Umschau.*

Longitudinal section through the "Deutschland."

1. Rudder. 2. Closet. 3. Small saloon. 4. Captain's bridge. 5. Ventilator. 6. Kitchen and dresser. 7. Living and dining room. 8. Hatch. 8a. Pump. 9. Laboratory. 10. Horse stables. 11. Dog kennels. 12. Provisions. 13. Large boiler. 14. Small auxiliary boiler for the dynamo. 15. Coal. 16. Provisions. 17. Various utensils. 18. Men's quarters. 19. Briquettes. 20. Chain ballast.

reached Scott's farthest south—82 degrees 17 minutes south. Christmas day found them at 85 degrees 55 minutes south, and by 9:00 A. M., January 9th, 1909, they had reached 88 degrees 23 minutes south. Beyond this point they could not go on account of the hard traveling and the exhaustion of their food supply. No mountains were visible beyond, and it is probable that the South Pole is situated on a level plateau 10,000 to 11,000 feet above sea level. After an extremely hard return journey on short rations, Cape Royds was reached March 4th, 1909. The "Nimrod" and the supporting and relief parties were there waiting, and the next day all started for home.

In addition to discovering the South Magnetic Pole and reaching a point within 110 miles of the South Geographic Pole, the main results of the journey were the finding of coal (showing that in the past this region enjoyed a mild climate), the procuring of a complete meteorological record and the discovery of eight distinct mountain ranges varying from 3,000 to 12,000 feet in altitude.

Into approximately the same period as Shackleton's expedition falls Charcot's voyage on the "Pourquoi Pas" in the Antarctic (1908-1910). In sportsmanlike spirit this French explorer refrained from entering a region which, as he considered, had been "staked out" by the British expeditions. "I resolved," he writes, "to return to the region which I had begun to explore on the "Français" in 1903-1905, i. e., that mountainous projection, due south of Cape Horn, improperly known under the general name of Graham Land. My exact object was to study in detail and from all points of view as wide a stretch as possible of the Antarctic in this sector of the circle." Dr. Charcot has presented an account of his travels in popular form in a very interesting book published under the title: "The 'Pourquoi-Pas' in the Antarctic."

No less than five south polar expeditions are at present in progress or contemplated. An English party is out under the command of Capt. R. F. Scott, while a Norwegian campaign is headed by Amundsen. Recently Sir Ernest Shackleton has made an appeal on behalf of an Australasian antarctic expedition under the command of his old comrade, Dr. Douglas Mawson, whose desire it is to chart a stretch of unknown coastline some 1,200 miles north of Capt. Scott's objective, and to check the readings made by former expeditions at and near the south pole.

The Japanese also are now for the first time entering the field, Lieut. Shirhase being expected to start out from Sidney in September. There seems to be a general impression among connoisseurs that the Japanese expedition is not properly qualified for successful work.

A German expedition started out from Hamburg in May of this year under the leadership of Dr. Filchner and Capt. R. Vahsel. The principal object of this expedition is to determine the relation of the eastern and western antarctic continent and to ascertain whether they are continuous or separated by water. A somewhat detailed account of the plans and equipment of this expedition is given in *Die Umschau*, from which our illustrations of the "Deutschland," the vessel which is to carry the explorers, are taken. The "Deutschland" was originally built in 1906 as a whaler, and is constructed wholly of wood, as this is found, by virtue of its elasticity, to resist the crushing effect of ice better than a steel hull. In fact a steel vessel is apt to be simply cut by the ice, while a wooden craft is pressed up out of the floes. The "Deutschland" is rigged as a three-master and carries a 300-horse-power auxiliary engine, which in an emergency renders the ship independent of the wind. The length over all is 183.7 feet, the beam measures 34.4 feet, and the depth 22.6 feet. The tonnage is about 580. The auxiliary engine is capable of developing a speed of seven knots. The propeller is two-bladed and can be drawn upon the deck when not in use, so as to protect it from the ice. The rudder is similarly arranged to be raised out of the ice.

The greater part of the ship's space is of course taken up by the hold which contains the provisions, the drinking water and the supply of coal for the three and one-half years which the expedition is planned to last. The general arrangement of the ship's interior is well brought out in one of our illustrations. The cost of the expeditions is estimated at $375,000, every cent of which has been contributed from private funds. The sledge journey is planned to start from the Weddell Sea (as indicated on our map). The final equipment of the ship for its journey will be made at Buenos Aires, where a part of the provisions, the automobile sledges, Manchurian horses and Eskimo dogs will be taken on board. The boat is lighted by electricity, and a powerful wireless telegraph apparatus, which will maintain communication with South America. The crew numbers thirty-five and the provisions take up 200 tons of the ship's space. The plans are laid with characteristic German thoroughness.

New Atlantic-type Locomotives for the Anglo-Scottish Expresses

Increasing Use Abroad of Large Boilers and Heavier Loads on Drivers

By Frederick C. Coleman

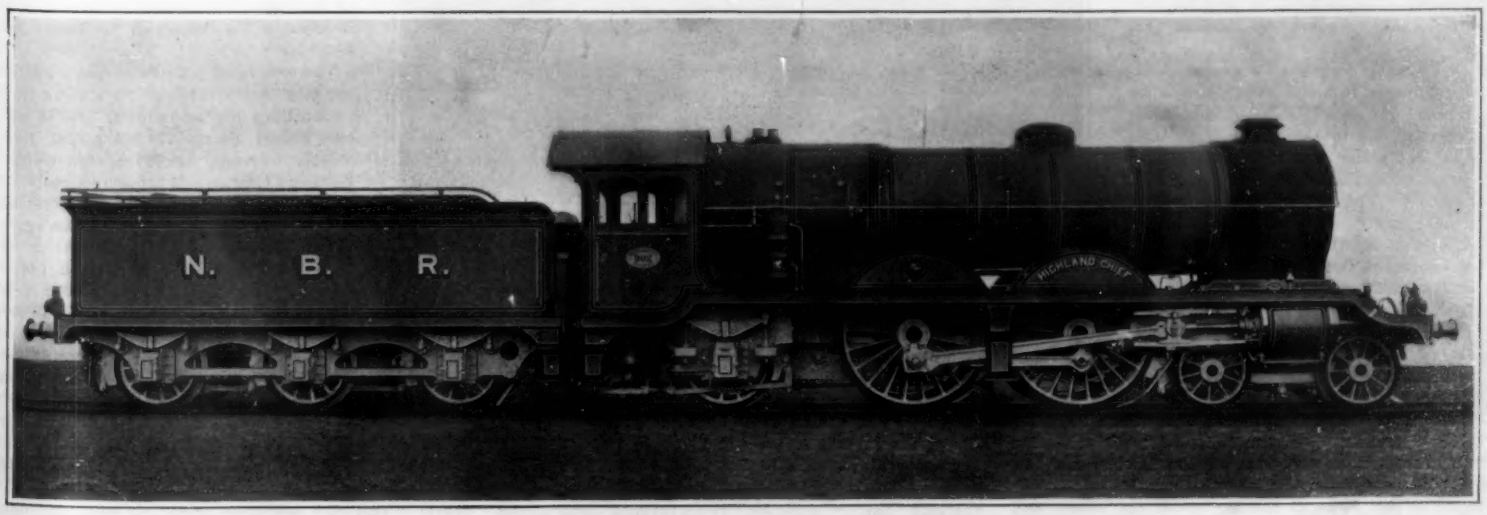
THE North British Railway Company has this autumn introduced six Atlantic-type locomotives for hauling the Waverley expresses. They were built by Messrs. Robert Stephenson & Company (Limited), of Darlington, England, to carry a 20-ton adhesion load on each coupled axle, which weight is usually regarded as the limit for British railways. An adhesion load of 40 tons in a four-wheel coupled locomotive for Great Britain needs large cylinders, and the dimensions here employed, viz., 20 inches by 28 inches, could not be exceeded without throwing an enormous strain on the steaming capacity of the boiler. The long piston-stroke facilitates easy starting, and, with the relatively large cylinder diameter, provides an ample volume for the expansion of steam, so that a low terminal pressure is assured without resorting to compounding. The cylinders are carried outside the frames and steam is distributed to them by means of piston valves actuated by Stephenson link motion. The cylinders are 6 feet 8½ inches apart between centers, and the pistons are provided with tail rods working in tubular sleeves. The main frames are set in at the rear of the bogie to permit of greater side movement on the part of the latter. The coupled wheels are 6 feet 9 inches in diameter, the bogie wheels 3 feet 6 inches in diameter and the trailing wheels have their axle boxes carried in outside framing, so that neither the length nor the width of the firebox, which is of the Belpaire type, need be restricted. The grate area is 28.5 square feet. The boiler has an outside diameter of 5 feet 4⅝ inches and the barrel is 15 feet 4¼ inches long between tubeplates. Its center is 8 feet 11 inches above the rail level and the working pressure is 200 pounds per square inch.

The total heating surface amounts to 2,256.6 square feet. The firebox contributes 184.8 square feet, and the tubes, 257 in number, and 2 inches in external diameter, the remaining 2,071.8 square feet. The engines are each fitted with combination injectors and lever reversing gear, and are provided with a steam cock with a reducing valve on the tender for carriage-heating purposes. Sandboxes have been provided for the leading and driving wheels, the sand being blown on to the rail by air pressure. The engines are equipped with standard Westinghouse brakes, and have a vacuum ejector and train pipes, so that they may handle vacuum brake-fitted trains, if necessary. The weight empty is 67 tons 2 hundredweight, and in working order 74 tons 15 hundredweight, this last being distributed: On the front bogie wheels, 8 tons; on the rear bogie wheels, 8 tons 7 hundredweight; on the four coupled wheels, 40 tons; and on the trailing wheels, 18 tons 8 hundredweight. The tender is of the usual six-wheeled pattern and of the standard North British Railway type, and it has a tank capacity of 4,200 gallons of water and 7 tons of coal, the weight in working order being 46 tons 5 hundredweight. In running order, these Atlantics have an aggregate weight on the rails of 121 tons, while the engine length is 38 feet ¾ inch, the total wheel-base 27 feet 9½ inches, and the length over buffers 63 feet ½ inch.

Three Million Matches a Minute

IT has been estimated that, for each minute of time, the civilized nations of the world strike three million matches. This is said to be the average for every minute of the twenty-four hours of the day. Fifteen hundred billion is the number for the entire year, and those persons who live under the American flag are charged with the consumption of one-half of this amount.

The importance of the industry which turns out the little splinters of wood tipped with sulphur or some other material ignited by friction, is only recognized when the average smoker tries to contemplate his predicament if he had to go back to the time when he had to coax a spark from a tinder-box. Small and insignificant as it is, the match demands as much attention in the choice of the wood involved in its manufacture as any other forest product. Only the choicest portions of the best trees are suitable. Sapwood, knotty or cross-grained timber will not do. Instead of being a by-product, the little match is turned out at hundreds of mills over the country where the by-products are bulky objects like doors, sash, shingles, sidings, posts, and cord-woods. The pines, linden, aspen, white cedar, poplar, birch and willow are the most suitable match timbers.



New Atlantic-type locomotive for the Anglo-Scottish expresses.

Engine weight loaded, 74¾ tons. Drivers, 6 feet 9 inches diameter. Cylinders, 20 by 28 inches. Heating surface, 2,256.6 square feet.

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

Instantaneous Roentgen Ray Photography

THE sharpness of Roentgen ray skiagraphs of parts of the body is often impaired by voluntary or involuntary movements of the patient. This difficulty would not exist if "instantaneous" or exceedingly short exposures could be substituted for the usual "time" exposures. In order to obtain Roentgen rays of sufficient intensity for use in instantaneous exposures, the Roentgen tube must be excited by a single electric wave or pulse, produced by a very large induction coil. In the well-known Veifa apparatus this result is accomplished by melting a fusible plug in the primary circuit by an overload of direct current.

The Erlangen firm of Reimger, Gebbert & Schall has recently put upon the market an apparatus in which the single wave or "unipulse" is produced by means of a specially constructed interrupter. This device consists of an amalgamated copper rod, surrounded by a closely fitting sheath of insulating material, and dipping into a vessel which contains mercury, covered by alcohol.

When the rod is drawn out of the mercury it draws some of the latter after it into the insulating sheath. The heat developed in the slender column of mercury by the strong current employed causes the column to break with explosive violence, and drives the mercury downward with great velocity, which is increased by the heat of the self-induction spark which immediately follows the rupture of the mercury column. The primary circuit is consequently broken with extreme suddenness, independently of the speed with which the rod is raised, and a spark of corresponding intensity passes between the secondary terminals. Fig. 1 shows the appearance of this spark in ordinary conditions and Fig. 2 shows the deformation produced by placing the spark gap in the strongest part of the coil's magnetic field. A Roentgen tube excited by this single induced wave, or "unipulse," emits Roentgen rays of sufficient intensity to make strong skiagraphs of thick parts of the body (Fig. 3) in 1/200 second.

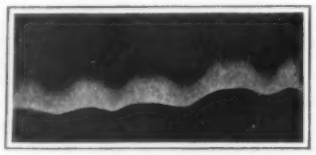


Fig. 1.—Unipulse spark.

Fig. 2.—Unipulse spark in magnetic field.

Fig. 3.—An instantaneous skiagraph.

Why Fog Signals Fail

IN a chart published by the United States Weather Bureau, and reproduced here in abridged form, Prof. A. G. McAdie discusses some of the phenomena presented by fogs and the difficulties and dangers which arise therefrom to navigating vessels, especially near shore.

The fogs of the Pacific, and especially those on the coast of California, Oregon and Washington, present some characteristic features of their own. They are low-lying, dense and of frequent and regular occurrence, and have been the cause directly and indirectly of a large per cent of marine disasters. In the vicinity of San Francisco, owing to the general movement of the air from the sea toward the land, and the climate of the great interior valley, fog is frequent and well marked. In summer the afternoon sea-fog varies in depth from 100 to 1,700 feet, but it rarely reaches far inland. On some afternoons the velocity of the wind at San Francisco rises with almost clock-like regularity to about twenty-two miles per hour, and a solid wall of fog, averaging 1,500 feet in height, comes through the Golden Gate, causing a fall in temperature to about that of the sea, namely, 55 deg. F. The upper level of the fog can be plainly seen from the hills in the vicinity, and it is interesting to note that above the fog level the air is cloudless, and the afternoon temperature ranges from 80 deg. F. to 90 deg. F.

While the Pacific fogs occur with peculiar regularity, those of the North Atlantic Coast, though at times persistent, are irregular both as to the time of their occurrence and their duration. The North Atlantic Coast fogs are probably due to thin strata of warm moist air passing over the cold water surface. The summer afternoon sea fogs of the Pacific are also quite different from the winter morning fogs. The latter lie low, close to the surface of the water, and do not average more than 100 feet in depth. It is nearly always possible, by sending out a look-out, to get above the level of the fog and thus obtain proper bearings. With the summer afternoon sea-fogs this is out of the question. The distance which the fog extends seaward is not definitely known, but it is thought that an average would be about 50 miles. There are instances when a fog has been reported several hundred miles off shore.

Whether a fog appears for a few hours at certain seasons, as on the Atlantic Coast, or regularly through the summer afternoons and the winter mornings, as along the Pacific Coast, whether it forms sharply defined streaks and strata, as at San Francisco, or lies in undefined banks, as off Newfoundland, in either case it is due to a cooling of the air and consequent condensation of water vapor. The cooling may be brought about by elevation and expansion or by rapid radiation or by mixture with a cooler mass of air or contact with a cooler surface. The water vapor condenses on minute nuclei which may be exceedingly fine dust or possibly ions.

The morning winter fogs are low lying banks of condensed vapor which, as a rule, move from the land seaward and are probably formed by a cooling due to radiation and contact, the land surfaces being much cooler in the early morning hours than the water surfaces, owing to the high specific heat of water. The summer afternoon fogs are probably due to cooling caused in part by elevation and expansion and in part by mixing. Fogs, as a rule, form when cool air passes over warm, moist surfaces, but in the case of the fogs near the Golden Gate, San Francisco, where the surface temperature is 55 deg. F., and the air temperature, at a height of 700 feet, 80 deg. F., condensation is more probably due to a mixing of air currents having different temperatures, humidities and velocities.

A billow on a sea of fog.

Fog surface broken by waves and splashes.

The seemingly unaccountable failure of fog signals at the critical moment has been a source of much perplexity and serious disaster. It not infrequently happens that the master of a vessel will testify that the fog whistle could not be heard, while light-house officials will maintain with equal positiveness that there was no failure to give the proper signal. It is now known that both sides may have been correct in their statements. If sound travels through a medium, such as air, the density of which varies more or less from point to point, it suffers a refraction, or, in other words, the line of propagation is not a straight line. As a result of this it may occur that a sound wave, starting from some point on the surface of the earth, is deflected upward, so that a person stationed at some distance on the surface of the earth will receive no indication of the sound wave, which passes over him, above his head, leaving him unconscious of the disturbance.

Another possible cause through which sound signals may become inaudible at certain points is the reflection of sound from sharply defined clouds or banks of dense fog. Such reflection may have the result that at certain points the direct wave and the reflected wave just neutralize and the sound becomes inaudible.

The troubles to which air signals are subject are completely overcome when water is used as the transmitting medium. The success of submarine bell signals has been so marked that in time the siren signals through the air will probably become of secondary importance. Where both signals can be employed and used simultaneously, a careful determination of the interval between the receipt of the two signals enables the mariner to obtain some indication of his distance from the point of starting of both signals, for obviously the time which elapses between the receipt of the two signals is the difference between the time taken for the air signal and the water signal to reach him. Now the velocity of sound in air is about 1,100 feet per second; in water about 4,700 feet per second. From these data the distances may be computed.

The same principle can be applied with still more satisfaction if one of the signals is given by wireless telegraphy and the other through the water. It is claimed that the bells used as submarine signals can be heard farther, under ordinary conditions, than the siren, and furthermore, by means of a special telephone apparatus, it is possible to determine the direction or the origin of the sound. The receiving apparatus consists of two tanks placed in the hold of the vessel below the water-line. These tanks contain microphones immersed in liquid and connected to the pilot house. An indicator box shows the side on which the responding telephone is connected, and the master is thus able to ascertain the direction from which the signals come.

The Rubber Supply of the Future

THE *Chemical Engineer* publishes an article by Mr. Walter Freudenberg of Bremen on the subject of the future rubber supply.

The estimated planted acreages of rubber as given by three of the leading trade publications are as follows: *India Rubber Trades Diary*, 776,000 acres; *India Rubber Journal*, 980,000 acres; *Gummi-Zeitung* (Berlin), 1,310,000 acres; Mr. Freudenberg takes the second estimate as the basis for future yields, and gives the futures supply as follows: From Malaya, 70,000 tons; Ceylon, 19,000 tons; Dutch Indies, Borneo, South Mora, and Burma, 20,000 tons; total annual supply of plantation rubber in 1916-17, 109,000 tons. To this must be added the probable supply of wild rubber, which until recently has been about 70,000 tons annually. He considers, however, that the supply from this source may decrease, and estimates only 35,000 tons, making a gross total of 144,000 tons in 1916-17. Statistics show that for the year ending June 30th, 1910, a total of 76,000 tons was used, showing an increase of 5 per cent annually during the past 10 years; if this rate continues, about 107,000 tons would be required by 1916-17.

Results of the Glidden Tour

Lessons to be Learned from the Annual Automobile Endurance Contest

INSTEAD of a distinctly technical contest, such as was held last year, the Glidden tour of 1911 was more of a pleasure event held for the double purpose of emphasizing the good roads movement in the South and at the same time of giving the 1912 models their first practical demonstration. The distance covered this year was only half that covered in 1911, being the 1,454 miles between New York city and Jacksonville, Fla.

The tour started on October 14th and ended October 26th. In all some 77 cars were included in the caravan, of which 64 competed. Fourteen, or about 22 per cent, finished with perfect scores, whereas last year, out of 27 contestants, none escaped without penalization. Instead of the rigid technical examination that occurred at the end of the tour last year, the rules this year merely required the reaching of controls on time. The cars were divided into teams of three, the winning team, of course, being the one with the fewest marks. In addition to this, the Chamber of Commerce of Anderson, S. C., donated a $1,000 prize for the car having the best score.

The first few days of the tour were very enjoyable, but the toufists encountered a cloudburst at Roanoke, Va., after which they were obliged to travel through exceedingly muddy roads, as well as to ford streams at several places. That they succeeded in doing the latter with the water almost up to the frames of the cars in some instances, speaks well for the manner in which the carbureters and magnetos are protected in the modern automobile.

In our report of the tour last year a warning note was sounded regarding that most important part of the car—the steering gear. The breaking of steering knuckles or the failure of other parts of this gear were in 1910 of much too frequent occurrence. This year but one such accident was reported, but that, unfortunately, was a fatal one. On the day before the tour ended the pacemaking car of J. P. Walker, in which the owner, his wife, and S. M. Butler, chairman of the Contest Board of the A. A. A., were riding as passengers, ran off the road into a field and upset when going at high speed. The chauffeur escaped unhurt, but Mr. and Mrs. Walker were both severely injured, and Mr. Butler was crushed beneath the car and killed. The accident, which occurred at Tifton, Ga., after the 42-mile run from Cordele had been made in an hour, was caused either by the steering gear giving way or from the car becoming unmanageable when driven at high speed through deep sand. The chauffeur claimed the former was the case. There was a great deal of racing throughout the tour, and it is a wonder that there were no other serious accidents.

The winning teams, with the points charged against them, were as follows:

1. Tarrytown (3 Maxwells) 0
2. Atlanta No. 2 (3 Stevens-Duryeas) 19
3. Jacksonville (3 Cadillacs) 28
4. Atlanta No. 3 (3 Fords) 125
5. Live Oak (3 Cadillacs) 279
6. Nashville (3 Marathons) 509

The fourteen cars which had perfect scores were made up as follows: 4 Maxwells, 3 Cadillacs, 2 Stevens-Duryeas, 2 Fords, a Columbia, a Mitchell, and a Flanders.

The winner of the Anderson trophy, who was picked by lot, was Governor Hoke Smith, of Georgia, with his Maxwell. Miss Roberta Marks, of Athens, Ga., was the only lady driver. She piloted her silver-plated Columbia, filled with several lady friends, through to the finish with a perfect score.

The fact that 11 of the 14 perfect-score cars were low-priced machines shows that the modern light-weight touring car, which can be bought for about $1,000, is, if anything, more dependable than a heavy high-priced machine, especially when it comes to traveling at high speed over rough and muddy roads. Under such conditions the light car has the advantage in every way, and to make it all the better, it is the cheapest to buy and to run.

Science

Stamp-vending Machines in the German Postal Service.—Automatic machines for selling postage stamps are now extensively used in German post-offices, and have effected a considerable saving in the postal administration, although convenience to the public was the prime motive for their introduction. Nearly 50,000,000 stamps were supplied by the machines during the past year, their value aggregating about $750,000.

Surfacing Concrete Electric Light Poles With Mica.—Ground mica is now being used extensively for surfacing concrete in cement work. It has proved very effective for this purpose as it gives an artistic finish to the work, and adds life and sparkle to the surface, taking away that flat, dead appearance that is common to concrete. About five pounds of mica is sufficient to cover 100 square feet. The electric light columns in Lincoln Park, Chicago, were treated in this way. Crushed red granite was used with the mica, so that the finished surface has the appearance of polished granite. The granite and mica surfacing material was applied to the inner surface of the square iron trough in which that part of the columns that was to extend above ground was cast. When the trough was filled, the top or lid was screwed down, crowding the concrete into all the lines and corners of the mold. After the cement had set perfectly, part of the mold was removed to permit the post to cure more rapidly. The post was not removed from the mold until it had set for 24 hours at least. After it was perfectly dry the surface was scrubbed with muriatic acid, to remove the cement on the outer face of the granite and mica and leave a clean surface closely resembling that of granite.

An Imperial Chinese Printery.—A few months ago the Chinese government began to erect a modern printery that will require a total expense of $2,000,000. Construction of the building and installation of the printing-plant have been intrusted to American architects. The present monetary system of China is so complicated that it is really a very emphatic hindrance to the development of trade and industry. In accordance with this system every individual province emits its own currency, and the standard of value is different in every province. For a long time, consequently, a persistent effort has been made to devise and introduce a uniform standard of value for the whole empire, and the construction of the printery in Pekin begins the transformation of the collective monetary system of China. Two years ago the government sent Dr. Chen to Europe and America to study the machinery, and its installation, of the most efficient printeries in these countries, and in accordance with his report the governmental printery of the United States in Washington was selected as a model. It is hoped that the Imperial Chinese Printery may be finished within two years so that it can begin work when Parliament opens in 1913. Besides other experts two American engravers have been employed already to supervise the installation of the plant and to instruct the Chinese in the art of engraving.

Engineering

Our Excellent Lighthouse Service.—It is a curious anomaly that the United States, which possesses the smallest foreign-going merchant marine in the world, should possess the most perfectly-equipped and elaborate lighthouse service to be found on the coast line of any nation. During the past half century this service has cost $150,000,000, and its maintenance calls for the appropriation of about $7,000,000 annually.

Panama Exposition Memorial Tower.—A concrete steel tower, which will be the loftiest structure, with the exception of the Eiffel Tower, in existence, is to be erected at San Francisco in connection with the Panama-Pacific International Exposition, which will be held in that city in 1915. From the floor to the top of the figure of Victory, surmounting the shaft, the height will be 850 feet. It is to consist of a square shaft upon a base 232 feet square and 120 feet high. The shaft will measure 85 feet on each face. The estimated cost of the structure is $1,500,000.

Daily Earnings of a Locomotive.—A writer in the *Railway and Engineering Review* recently gave the interesting results of a computation of the average daily earning capacity of the American locomotive. The estimate took account of time spent in the repair shop, increased cost of repairs and renewals, and the cost of fuel, water and the engine crew. The average earnings per locomotive per day in the East are $124.84, and on the western roads, $130.84. The highest earnings in the West are those of the Santa Fe locomotives, which work out at $149.53 per day. The highest earnings in the East are on the Central Railroad of New Jersey, where the average is $147.06 per day.

Steam Turbine Improvements.—The superiority of the reciprocating engine over the steam turbine, when a ship is steaming at low speed, is destined to disappear. At high speed the turbine possesses every advantage; but at low speed it is extravagant in its use of steam. Of the several systems of reduction gear by which the widely different economical speeds of propeller and turbine are sought to be harmonized, the electric drive seems to present the most promise. A better method would be the proper combination of reciprocating engines for low speed and turbines for high speed. The navy has under consideration a system of this kind which we hope shortly to present for the consideration of our readers.

Our New Three-gun-turret Battleships.—Plans and specifications are now being prepared in the Navy Department for the two super-dreadnought battleships authorized at the last session of Congress. These ships, which will be named the "Oklahoma" and "Nevada," will contain many novel features, the most important of which will be the introduction of the three-gun turret, of which there will be two, containing six 14-inch guns. The other four 14-inch guns will be carried in two-gun turrets. The armor plan has been worked out with great care; and we understand that these ships will be protected by a thickness of face-hardened armor which has never been attempted in any battleship in our own or foreign navies.

Aeronautics

Results of the Tests for Military Aeroplanes in France.—The preliminary tests of the 29 machines entered in the competition for military aeroplanes in France have resulted in the elimination of 5 of the 8 monoplanes and 14 of the 19 biplanes. Neither of the two triplanes—the Astra and the Paulhan—was selected. The machines which were scheduled to participate in the final 185-mile speed race on November 4th were the Morane, Nieuport, and Deperdussin monoplanes, and the Breguet, Savary, H. Farman, and M. Farman biplanes. We expect to publish a complete account of these tests in our next issue.

The Trans-continental Flight Nearly Completed.—On November 1st Aviator Calbraith P. Rodgers covered 177 miles between Wilcox and Maricopa, Ariz., and got within 400 miles of the coast. At Tucson, the half-way point, he met Robert G. Fowler, who arrived there October 30th on his flight from the Pacific to the Atlantic, and who was delayed with engine trouble and an accident upon restarting. The two dauntless Wright pilots shook hands, congratulated each other, and hoped for better luck. Rodgers found a number of broken rollers on the propeller chains of his biplane, and was delayed at the start in replacing them. Then he had to breast a 30-mile head wind and to climb considerably to get through the 4,351-foot Dragoon Pass. He fought a head wind throughout the entire day, his time *en route* being 1¾ and just over 2 hours, respectively. November 2nd he flew 35 miles to Phœnix in 35 minutes, and 105 miles to Stovall in 118 minutes, aided by a strong wind. He beat his special train by over two hours.

Recent Aeroplane Fatalities.—The last month has witnessed the passing of the hundred mark in aeroplane fatalities. October 12th aviator Level fell to his death in a Savary biplane which he was piloting in the French army tests. His spine was broken and he died soon after. Two other French aviators—Horta and Germain—also fell the day previous. One was killed and the other fatally injured. The hundredth victim of aviation was Hans Schmidt, who fell at Berne, Switzerland, on October 14th, and was incinerated as a result of the ignition of his fuel. On the 21st ult. an aviator named Tacks fell and was killed near Hamburg. The loss which was most keenly felt in America, however, was occasioned by the death of Eugene Ely, the Curtiss aviator, at Macon, Ga., on October 18th. Ely was making one of those daring dips for which Hamilton became famous, when he miscalculated and struck the ground with terrific force. He was thrown out and his neck was broken. Ely was using a machine without any front control, while he had been used to a biplane with a front horizontal rudder. The slower response of the former type to a movement of the elevator was doubtless responsible for Ely's death, although the immediate cause was the performing of foolhardy tricks. On October 27th Jean Desparmet fell 600 feet in a 100-horse-power Blériot military monoplane at Rheims, while on the 31st Prof. John J. Montgomery was killed in California.

New Development in Aeroplane Construction

Three European Types Embodying Unusual Features

By Grover Cleveland Loening

QUITE recently there have been brought out in Europe several radical types of aeroplanes characterized by novel departures from accepted practice; and by far the most interesting ones are the new Antoinette, the Pivot, and the Short "twin" engine biplane.

Up to a few months ago, the aviation industry as a whole exhibited work of much ingenuity and cleverness but was wofully lacking in those fine points of pure engineering that go to make any field of applied science a successful one. With the new types that have been developed abroad, however, it appears that thoughtless copying of a few successful "experiments" is giving way to a more detailed and careful study of the countless different conditions occurring in the practice of flying, upon which designs with definite ends in view are being perfected. The Breguet biplane and the Nieuport monoplanes may truly be said to represent the pioneer stage of aeronautical engineering, representing as they did, a much higher state of development than any other types. But in France, especially, progress is rapid and it is almost safe to predict that in a short time the Nieuport will be out of date. Many weak features in this type have already been discerned, notably the shape of the body and the landing chassis. At any rate, about the most hopeful sign yet exhibited in the progress of the flying industry is the design and development of aeroplanes with other ends in view than the mere ability to fly and to land without collapsing. Ease of packing for shipment and speed in erection and "tuning up" are factors of great importance that are receiving careful consideration. Many dispositions likely to add to safety and a reduction in the number of parts with a view to simplifying and cheapening manufacture are being developed. So it may fairly be said that we are beginning to emerge from the embryo state of aviation to one that is likely to hasten the advent of its full commercialization.

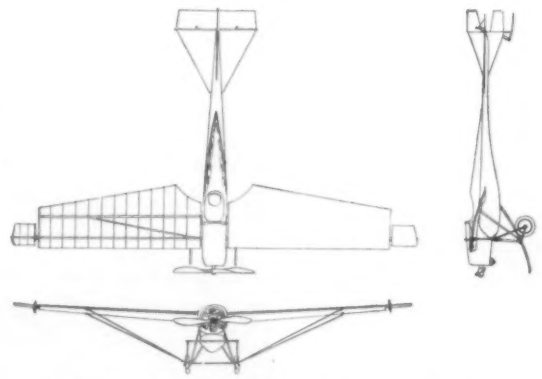
Each one of the types described here bears one or more distinguishing features and they have been admirably adapted in practice to the work for which they were designed.

The Antoinette Monoplane.

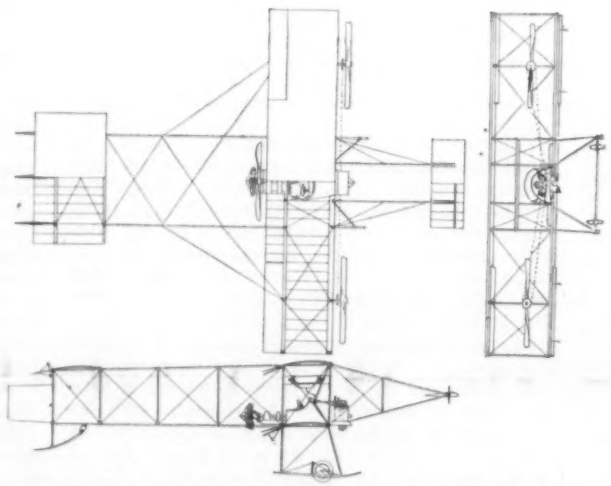
The new Antoinette monoplane, designed especially to take part in the French Military Competition, has an unusually radical appearance. This machine, primarily intended for military purposes, is equipped with armor plate protection about vulnerable parts like the motor and chassis, but its most important feature is the total elimination of cross wires, struts and the like. All parts are inclosed—even the wheels and skids—with the result that the resistance is greatly decreased, but the weight increased. In addition a peculiar wing section is used, flat on the under side and curved on the upper side. This type of wing section, as learned from aerodynamical experiments, has a very bad drift resistance at low angles and a very uniform rate of change of the ratio of lift to drift at low angles. The center of pressure as the angle of incidence decreases below 10 degrees does not move back as rapidly as on other shapes. This type of wing is therefore more stable and of smaller resistance. The distribution of pressure, however, is very uneven, but because of the great strength of the planes themselves, at all points, this is not a detrimental feature.

The wings are immensely thick, being entirely braced from the inside. At the body the wings are over two feet thick, something altogether without precedent in aviation. Their thickness decreases toward the tips, which are about 8 inches thick. The shape of each wing is trapezoidal, and they are at a large dihedral angle. This adds to the stability in a calm; in a gusty wind conditions arise where a large dihedral angle is thought by many to be dangerous.

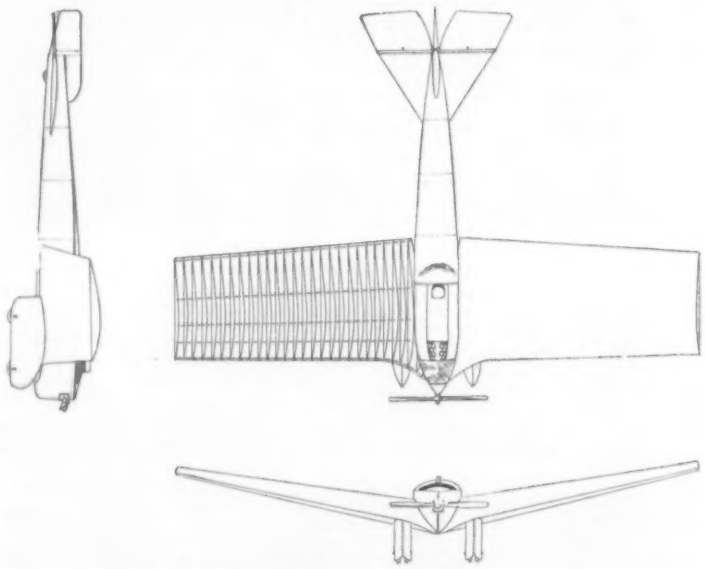
The boat-like body of this new type is entirely inclosed and is capacious to say the least. At the front is the motor, the aviator sits in the body between the two wings, and at the rear are the rudders. The body has a stream line form, and a splendidly shaped prow.



Drawings of Pivot monoplane with ailerons.



British two-motor biplane constructed by Short brothers.



Plan and elevations of "armored" Antoinette monoplane.

Side view of "armored" Antoinette war aeroplane.

NOVEL FOREIGN AEROPLANES

A two-bladed Normale propeller at the front pulls the machine forward. The motor is a regular 100-horse-power Antoinette, but the machine will fly with a 60-horse-power motor.

The oddest feature of this type is the landing gear, which is entirely inclosed to within a few inches of the ground; the landing wheels at the front are six in number, three on each side of the center, inclosed in what is called a "skirt." At the rear are two smaller wheels.

The dimensions are roughly as follows: Spread, 52½ feet; area of supporting surface, 602 square feet; length over all, 36 feet; width of wings at tips, over 9 feet, increasing to almost 13 feet at the center. The total weight, including fuel and operator, is nearly 2,400 pounds.

The aviator obtains a view beneath him through a glass floor under his seat. For the reduction of resistance, even the exhaust pipes of the engine are inclosed in a stream line shield.

This type is certainly birdlike in its appearance and immense in size, but whether the great sacrifices made to eliminate projecting spars or wires are wise remains to be seen. For a purely speed machine it would be wise, without a doubt. There is a large expanse of vertical surface in this machine which is likely to make it difficult to handle, especially in a wind. A number of successful flights have already been made, however.

The Short Biplane.

An aeroplane, equipped with two motors, which has already completed duration flights of over an hour and is therefore capable of fulfilling the conditions of the Gould Prize, has been built in England by Short brothers.

In general outline it is a biplane of the 1910 Farman type, equipped with two 50-horse-power Gnome engines placed centrally one in front of and the other in the rear of the lower main plane at either end of a nacelle or inclosed body. The front motor drives two propellers by chains in opposite directions, precisely as on the Wright biplanes. The propellers are of high pitch, shaped like Wright propellers, but are at the front of the main cell. The rear motor drives a single low pitch propeller at high speed, as on the usual Farman type.

It is possible to operate either motor separately or both together. The entire mechanism has worked to the utmost satisfaction, its feasibility being proved beyond a doubt.

The aviator sits in the nacelle, a passenger seat at his side. The rudder and aileron controls are of the usual Farman type.

The landing chassis and in fact all details of construction are very strong.

With the immense extra power available—one motor alone sufficing for ordinary flight—this type has the ability to go fast or slow, and, in addition, on occasion can climb with great rapidity, with its full 100 horse-power. It is to be noted that the axes of the front propellers and the rear one are not on the same level. This is designed to counterbalance the effect on the tail, had by the draft from the rear propeller. As soon as the latter ceases to operate the lifting tail sinks, but the higher position of the axis of thrust of the front propellers at once overcomes this.

The dimensions are as follows: Spread, 34 feet; chord, 6½ feet; supporting area, 435 square feet; weight in flight, 2,000 pounds. The speeds are said to vary from 35 to over 50 miles an hour, depending on the amount of power used.

The Pivot Monoplane.

A highly interesting monoplane has recently been brought out in France, known as the Pivot. Its distinguishing features are the use of ailerons for

transverse control and the manner in which the planes are braced.

The body, of stream line form, suggests a combination of the Deperdussin and Breguet. The motor is at the front covered by a well designed hood. The pilot is comfortably seated at the rear of the main planes which are notched to enable him to have a clear view. The span of the planes is 34½ feet and their area 174 square feet. The weight of the machine is about 800 pounds in flight. A 45-horse-power Rossel-Peugeot motor is used. The wing section is of the now familiar Nieuport type, the wedge-shaped entering edge, however, being noticeably larger, and the reverse curvature at the rear somewhat sharper.

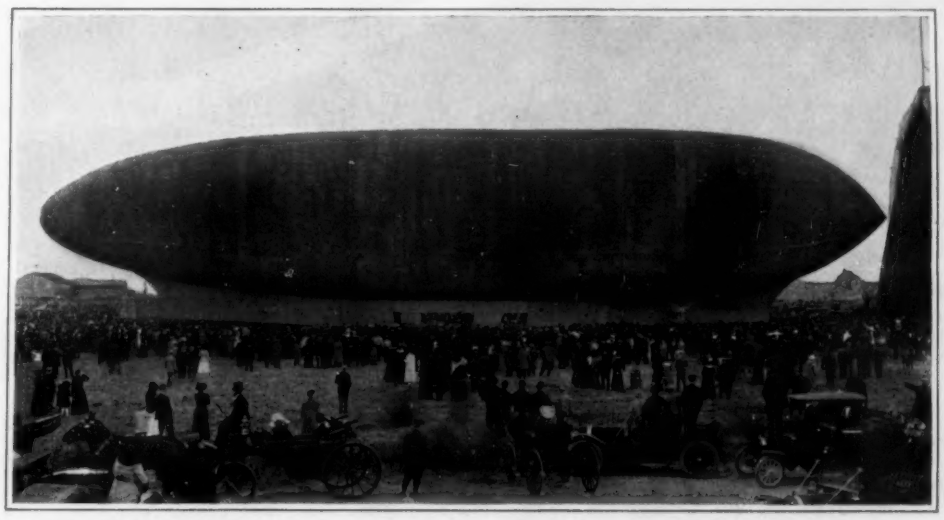
For some time, many engineers have been awaiting the monoplane that should cease to have its planes braced by wires—tension members—above the planes, where they never receive any tensile stress except upon landing. As soon as the machine takes to the air with the full pressure acting on the surfaces, the wires above the plane are relieved of all stress and must in consequence hang more or less loosely, thus generating a considerable resistance. It is recognized, however, that in gusty weather, reversals of stress are likely to take place and tension members alone on the under side of the planes would not suffice. There are two ways, however, in which monoplanes can be efficiently braced with the fewest parts and least resistance. The first way is to have compression members alone, capable of taking tension as well above the planes, and the other is to have tension members capable of taking some compression without undue bending below the planes. It is this latter method that is used on the Pivot, two steel tubes below each plane alone sufficing to brace it solidly to the chassis. The results so far have shown this to be an excellent provision, no other bracing wires being necessary. Another novel feature is the use of ailerons instead of warping.

Preparations for Launching the "Akron" for Its Trial Trip

Preliminaries for a More Complete Test

THE announcement was made on October 26th that Mr. Vaniman might, on the next Saturday, make a trial trip with his airship "Akron," familiar to our readers as the craft that is to carry its captain and crew across the Atlantic some time this autumn. While the public has been disappointed so far as the trial trip is concerned, which, at the time of writing, has not yet taken place, the preparations for the trip and the attempt which was made to start out on it, were in themselves of sufficient interest to deserve brief mention in these pages.

Early in the afternoon of Sunday, October 29th, Mr. Vaniman began to make preparations to lead his giant airship out of the shed and, if possible, to make a trial flight. The weather conditions were very favorable, though there was a slight wind blowing, sufficient to call for caution in the handling of the dirigible as it emerged from the shed. A large crowd had assembled in front of the hangar, its front ranks forming a semi-circle around the rope that had been put up to fence off the public from the space allowed for the launching of the airship. The preparations consumed a good part of the afternoon, but finally the "curtains" that form the door of the shed were drawn aside and, loudly cheered by the crowd of people, the leather-colored envelope of the "Akron" began to thrust its rear out of the shed, as a gang of about one hundred men, holding on to the anchoring wires and to the keel of the car, slowly moved the airship out into the open. Even to those who had become quite familiar with the aspect of the balloon by frequent visits to the shed, which was open to the public for a small fee, it was an imposing sight now to see the great craft fully disclosed to broad daylight, with the view unobstructed and the airship out in the open, apparently ready to be launched. This was the first time that the balloon had left the shed, and the men handling it were largely new to the work, so that it was an experiment of some interest. In spite of a wind that was not by any means negligible, the operation was performed perfectly and without a hitch. About two-thirds of the men holding the balloon were firemen and policemen of the Atlantic City force, the remaining one-third being made up of the regular workmen.



Copyright 1911, by Harper Smith

Airship "Akron" in which Mr. Vaniman expects to cross the Atlantic.

No attempt was made on this occasion to make a flight or even to run the engines, but the dirigible was simply led back into the shed just as it had been brought out, and with the same success.

It will be recalled that the airship carries two sets of propellers—one with fixed axes and the other revolvable in such a manner that the propellers can be made to exert their thrust in any desired direction. The first set of propellers and its engine seemed to work satisfactorily, but the right-hand propeller of the second set gave much trouble, its bearings giving out repeatedly whenever the engine was tried. The mechanics were kept busy upon this propeller, the work being carried on deep into the night, and by the next morning, Monday, the indications were that an actual trial would be made that afternoon. As is not unusual in such cases, numberless little complications arose, which delayed the work, so that by the time the balloon was ready once more to be taken out of the shed, it was rather late in the afternoon. The engines were tried in the shed and seemed to work well. The crew and several passengers got on board, and Mr. Vaniman gave the word for the "Akron" to be slowly drawn out. The operation was performed with the same success as on the previous day, the balloon being slightly turned so as to point into the wind. The attempt to start the main engine from the auxiliary engine, however, proved futile. It appears that a pin in the clutch lever had given out and it was found impossible to repair the damage at short notice. Thus a seemingly trifling cause rendered the flight that afternoon impossible, and with considerable disappointment the crowd presently saw the balloon once more retreating into its hangar, as dusk began to fall.

While to those who were expecting to see the airship ascend, the performances of Sunday and Monday must have been disappointing, yet they were really very instructive and interesting. When we consider the great number of little points that require attention, and are liable to go wrong, the wonder is not that these first trials failed to give immediate success, but that it is at all possible to get the entire equipment of the airship under such complete control that it can be relied upon at any instant during an extended flight, a condition which evidently must be most rigidly satisfied for the proposed trans-Atlantic trip.

It is with the greatest interest that we shall follow the accounts of further trials which will precede the actual journey. The time of the year is advancing, and it is to be hoped that successful trial trips will be made within a short time, so that the actual journey may be started before the favorable season of the year closes.

Foreign Accent Marks

A LEADING theatrical company recently toured the United States playing Sardou's "Divorçons." Throughout the country the billboards announcing the event printed the name of the play, in letters a foot high, "Divorcons." This word, written with the right kind of a *c*, is French, pure and simple. It admits of no anglicization. As transmogrified by the American printer, it is neither French, English, nor Swahili. As the second syllable, thus printed, rhymes with *pork*, it may be Chicagoese.

Ours is a land of paradoxes, one of the most striking of which is the fact that a people largely recruited from continental Europe should have come to the conclusion that the accent marks used in their various mother tongues are superfluous appendages—mere ornaments, like the paper frills of a French chop. Nothing could be farther from the truth. The European languages, except English, follow the common-sense plan of writing a word as they intend it to be pronounced. Before certain vowels the sound of *c*, in French, bears no resemblance to that of *ç*. They are, in fact, different letters. *Condé* does not rhyme with *Fronde*. In German, *ü* is the modern method of writing the diphthong *ue*. When Herr Müller accepts American citizenship as Muller, he is simply repudiating his family. Better call himself Miller and be done with it. Max Müller was still Müller after fifty years in England, and we are glad to observe Hugo Münsterberg correctly spelled in "Who's Who in America" and other dignified literature. Not so, however, in the American newspapers.

A few years ago an international scientific congress met in Washington, and the local papers paid the foreign visitors the delicate attention of printing their proceedings in what was intended to be French. The result was amazing. Columns of a hybrid language appeared, containing not a single accent. Expostulation with the editors was met with the explanation that the type-setting machines had no accents on their keyboards. Why, under these circumstances, the newspapers attempted the impossible was not explained.

The daily press both directs and reflects popular usage. It would be difficult to decide whether the newspapers or the public should be held responsible for the obsolescence of the foreign accent in America.

A painstaking examination of the practice prevailing in such matters reveals the startling fact that only one French word is now generally supposed, in this country, to require an accent. This is the word *buffet*. This euphemism for a public bar has become popular in America during the past decade. The word greets us at every street corner, always duly provided with an accent. The kind of accent, as well as its position, is a matter of individual taste. We have seen *buffét*, *buffèt*, *buffêt*—and even *buffeî!*

Are there any readers of this journal who need to be told that *buffet* is accentless in French?

Frequency of Electric Oscillations Proceeding from a Spark

THE luminous track of a short electric spark owes its presence to variations in field intensity due to the capacity of the electrodes and the ionization of the air. As a matter of fact it is well known that the spark is oscillatory in character. By blowing a steady current of air through the spark formed at horn electrodes, M. C. Caudrelier, as reported by *Cosmos*, has succeeded in separating the successive tracks of the oscillatory spark by several millimeters; knowing the velocity of the air (20 meters per second) and the distance apart of the individual spark tracks (2 millimeters), it is possible to measure the frequency of the oscillations. In this way it has been found to be of the order of 10,000 periods per second.

A Landsman's Log Aboard the Battleship "North Dakota"—III.

By J. Bernard Walker.

This Landsman's Log is written by the Editor of the SCIENTIFIC AMERICAN as a preliminary to a magazine Naval Number to appear December 9th, which will be comparable in its size and completeness with the Naval Number issued during the Spanish War. In one respect it will be unique, for it will contain a signed message from President Taft, and will be written entirely by prominent officers of the Navy, each a specialist in the particular field that he covers. The leading article, moreover, will be from the pen of the Hon. George von L. Meyer, the Secretary of the Navy. The illustrations will consist of special photographs taken during the recent maneuvers and target practice of the Atlantic Fleet on the Southern Drill Grounds.

THAT ever-memorable two weeks' cruise with the Atlantic fleet was full of the unexpected and surprising. Returning late one afternoon from witnessing aerial target practice aboard the "Michigan" (of which more anon) I entered my stateroom to find it in a condition of weird disorder. The bureau had been pulled away from the wall, and its glass taken out, wrapped in a blanket and laid on the floor. Beside it, upside down, was the wash-bowl, while the water pitcher had been put to bed in my berth, where it reposed, in comical gravity, upon the pillow. On the bedding lay, also, a heterogeneous collection of bottles, pictures, electric light fixtures, and even the electric fan. "Rough house" on board the "North Dakota"? Impossible! "Hazing"? Yes, to be sure—hazing the landsman. What more natural and appropriate? Had I not, when crossing the line, seen Old Neptune come aboard, when the luckless landlubber was belathered and gently scraped with a barrel stave? So, chuckling over the fun of it all, I went to the wardroom mess, and saw, would you believe it! the piano slung from the ceiling by a couple of stout ropes, and looking even more grotesque than my tornado-stricken stateroom!

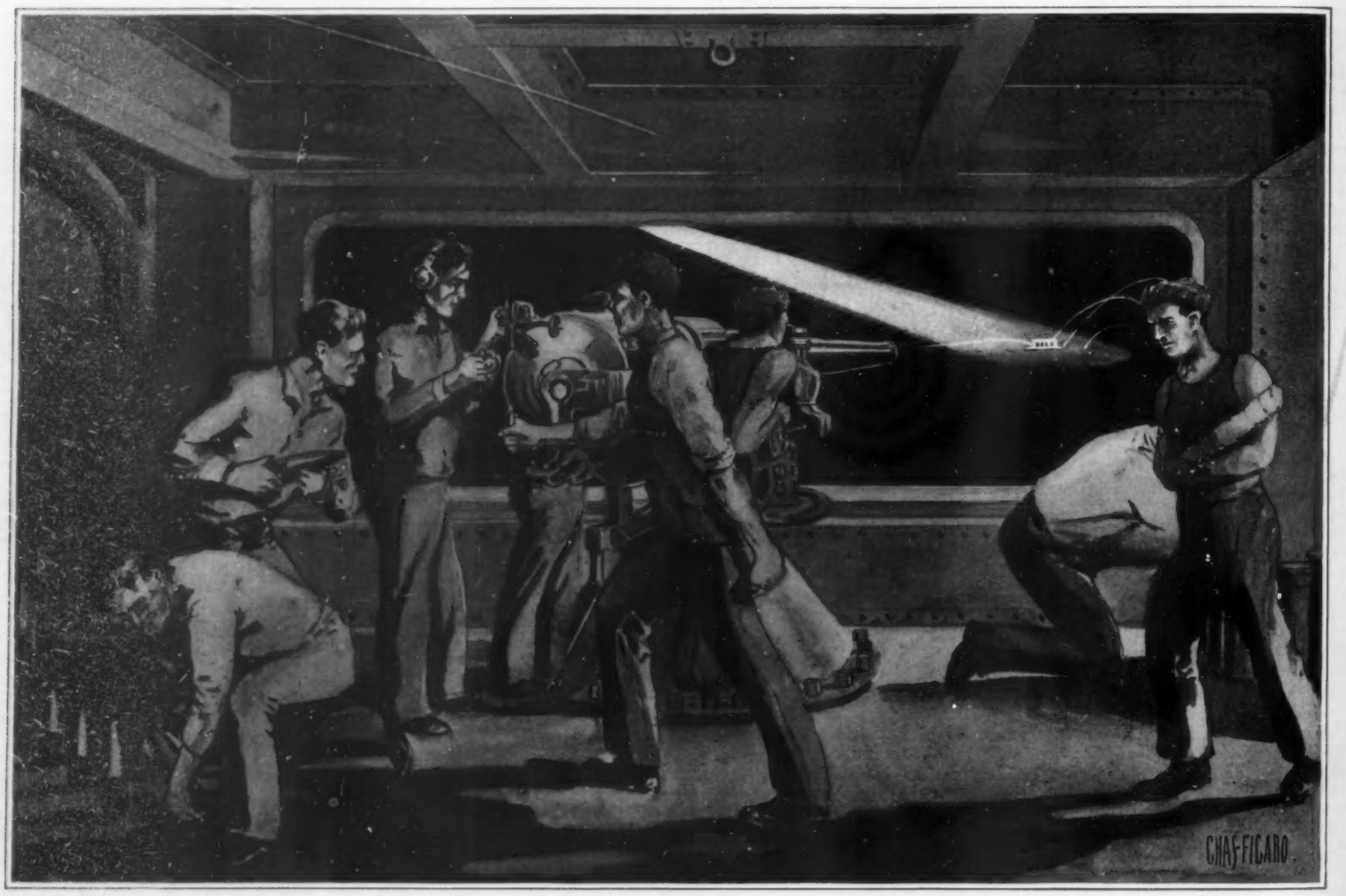
Had the good ship's company gone crazy, or had I? Neither the one nor the other, gentle reader. This was merely a very necessary preparation for target practice by our battery of fourteen 5-inch rapid-fire guns; for the discharge of even these relatively small pieces so jars the ship, that any glass or porcelain that was held rigidly in place would be shattered. Even the strings of the piano would snap.

At mess I got the full particulars. The "North Dakota" had fought a terrific battle during the day in which she had been pretty badly knocked to pieces Big guns disabled—shot holes at the waterline—a compartment flooded—one smokestack gone, the other riddled—speed reduced, and all the other etceteras of damage by shell fire. It had been a drawn battle; but the adjoining coasts of the enemy were swarming with destroyers, and they would undoubtedly be sent in among our crippled ships for a night attack.

And so, when the mess tables had been stowed, the "North Dakota" weighed anchor, and, with lights out, slid silently away from the fleet into the night. No one knew where the enemy might be, or from what quarter the dreaded destroyers might rush at us out of the blackness. It was for us to find him, and pour such a hail of high explosive shells upon the oncoming craft, that they would be disabled or sunk before they could get within range, round to, and start the dreaded Whiteheads upon their fatal run. I went on deck and climbed onto the roof of No. 3 turret, which I found to be crowded, as were the roofs of the other turrets, with sailors (chiefly the turret crews) who had taken this point of vantage to watch the attack.

Suddenly there came a crackling and spluttering from the top of the search-light towers, and half a dozen beams of light stretched their long, ghostly fingers out into the murk. To and fro, far and near over the ink-black waters, they swept, while the great ship, silent, tremorless and dark, forged slowly ahead. It was a tense quarter of an hour, and just as one felt a touch of impatience, there shone out, some 2,000 to 3,000 yards distant, a moving target, looking whiter even than the search-light beams. The target consisted of four squares of gray canvas on a ground of lighter hue, each square the size of a destroyer approaching head-on.

And then comes a flash, more blinding than any lightning stroke, and the crash of an explosion, more wicked and penetrating than the loudest snap of any artillery of the heavens! And see that beautiful, slightly-curving streak of phosphorescence, heading straight for the first square patch. That is the smoke of the shell "tracer." The tracer is a small plug containing combustible material, which is inserted into the base of the shell. It is ignited at the instant of discharge, and throws to the rear a dense trail of smoke, which serves to show the path of the projectile, and assist the spotter and sight-setter in making the necessary corrections for the next shot. The 50-caliber 5-inch rapid-fire gun is a superb little weapon. The shells leave the muzzle with the high velocity of 3,000 feet per second. Consequently the trajectory is very flat, and the moment the blinding flash of the discharge is out of one's eyes, it is possible to see a little phosphorescent spot rise slightly above, and then curve down to, the distant target. It curves so slightly that the 2,500 yards seems to be almost a point-blank range. Then comes the splash and the ricochet—the last-named, because of the high velocity, reaching a great height, sometimes curving upward a thousand yards or more into the heavens.



"And then comes a flash, more blinding than any lightning stroke, and the crash of an explosion, more wicked and penetrating than any artillery of the heavens! And see that beautiful, slightly-curving streak of phosphorescence, heading straight for the first square patch. That is the smoke of the shell 'tracer.'"

REPELLING A TORPEDO NIGHT ATTACK

In all target and battle practice, the time element, as well as the accuracy, is taken into account, in determining the relative excellence of the work done by the various guns. Hence, the report of the guns came in rapid succession; and often it was possible to see several shells in the air at the same time, one or two between gun and target, and several others—earlier shots—completing their ricochets in a series of vast sweeping curves extending miles beyond the target, the shells bounding over the black waters like a series of luminescent tennis balls.

Commencing forward, with No. 1, each battery in turn fired its quota of rounds. The guns flamed and roared down the line until No. 14, the last on the port side, had let go its last shell. The "North Dakota" then headed for the target, to learn what kind of shooting she had done, and sent a boat over to

remove the shattered squares of canvas and put fresh ones in their place for the next run, with starboard batteries engaged.

Acting gladly on the suggestion that I should now stand in one of the gun casemates and witness at close range the work of the gun crew, I chose battery No. 13, the aftermost battery on the starboard side. The casemate port is cut away to allow the gun to be trained dead astern; and the great width of the opening, coupled with the fact that this gun carries no shield, affords a large field of view for watching the course of the shells. What I saw, our artist has endeavored to depict in the accompanying engraving. It should be understood that only a part of the gun crew is shown. As a matter of fact, in addition to the officer in charge, there are ten men to each gun. First, the gun captain, in charge of the crew, who opens and closes the breech. Second, the pointer, who stands to the right of the gun, on a platform attached to and moving with the gun mount. This man, by means of a handwheel, elevates and depresses the piece, keeping the horizontal wire of the telescopic sight upon the target. He also fires the gun by trigger, closing an electric circuit. Third, the trainer, who stands on a similar platform to the left of the gun. His duty is to keep the vertical wire of the telescope upon the target, which he does by means of a handwheel that trains the gun to right or left. Fourth, the sight-setter, with telephone head-piece in place, who stands to the rear of the trainer, and by means of a graduated disk and cylinder, sets the sights according to directions as to elevation and deflection, telephoned to him by the spotter, who is watching the fall of the shots from some elevated position on the ship. Fifth, the loader. Sixth, the primer man, who inserts the primer the instant the breech is closed. Seventh and eighth are the first and second powder man; and ninth and tenth are the first and second shell man. The battery here shown was manned by a detachment of the marines, of which most efficient corps, 66 men and two officers, a captain and a lieutenant, are to be found on each first-class ship.

As I entered the casemate, No. 2 battery on the port side commenced firing, and battery after battery roared and flashed down the ship's broadside. I noted that to the right of the gun and to the rear of the group of men stood a row of copper cases, each containing its charge of powder neatly sewed up in a canvas bag. On the opposite side of the crew was a row of sharp-nosed 5-inch shells. As the din of the firing comes nearer, there rings out the sharp command to "load." Instantly, with one swing of the lever, the gun captain opens the breech; the shell man thrusts home a shell, and the powder man the powder charge. With another swift swing of his arm the gun captain brings over the breech block, which is slammed into place and locked. Meanwhile the powder men, shell men and primer man have picked up their respective pieces, and stand ready for the next loading. Months of training have developed the gun crew to a point at which (were it desirable) the gun could be fired at the rate of twenty shots every minute.

And now the heavy jar of the ship, the blinding flash and curiously stunning effect of the discharges, tell us that No. 11 gun in the next casemate is engaged. The tension increases until it is almost a pain; the crew stand as alert as a football team waiting for the pass of the ball! Pointer and trainer, each with eye to the telescope and shoulder crowded firmly against the gun sleeve, are ceaselessly rocking the handwheels to and fro as they keep the wires upon the distant gray patch upon the target. "Fire!" comes the command—the steel floor of the casemate shudders, there is a flash that seems to burn the very eyes out of their sockets, and a curious suffocating sensation at throat or chest, and I am peering eagerly through the casemate opening to watch that little magic phosphorescent pencil point trace its tell-tale path to the target. Nine times in succession comes that amazing burst of flame and ear-splitting crash—and the night firing for 1911 is over.

Later, and long past the midnight hour, the canvas targets, each rolled up on its battens, are brought aboard the quarter deck to be inspected by the ordnance officer and the umpires. One of the searchlights is turned down upon the deck, and one by one the targets are unrolled and the shot holes counted. Ordinarily the sailors turn in early—but not to-night. Massed around the targets, crowding the rail on one side and the 12-inch turrets on the other, they watch the count, looking eagerly for those little jagged holes in the cloth which tell of the passage of the shells. Less demonstrative, but no less eager, is the interest of the officers—and when it was told that 98 hits out of 120 rounds had been made, and the "Delaware's" score of the previous night had been beaten, the enthusiasm of that ship's company was as that of the grandstand and bleachers, when the home team has come out ahead in a championship struggle.

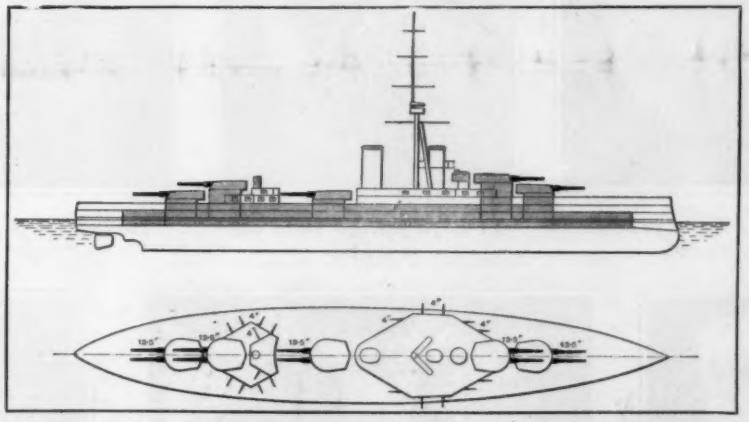
(To be continued.)

The Battleship "Orion"

The First British Super-Dreadnought

By Percival A. Hislam

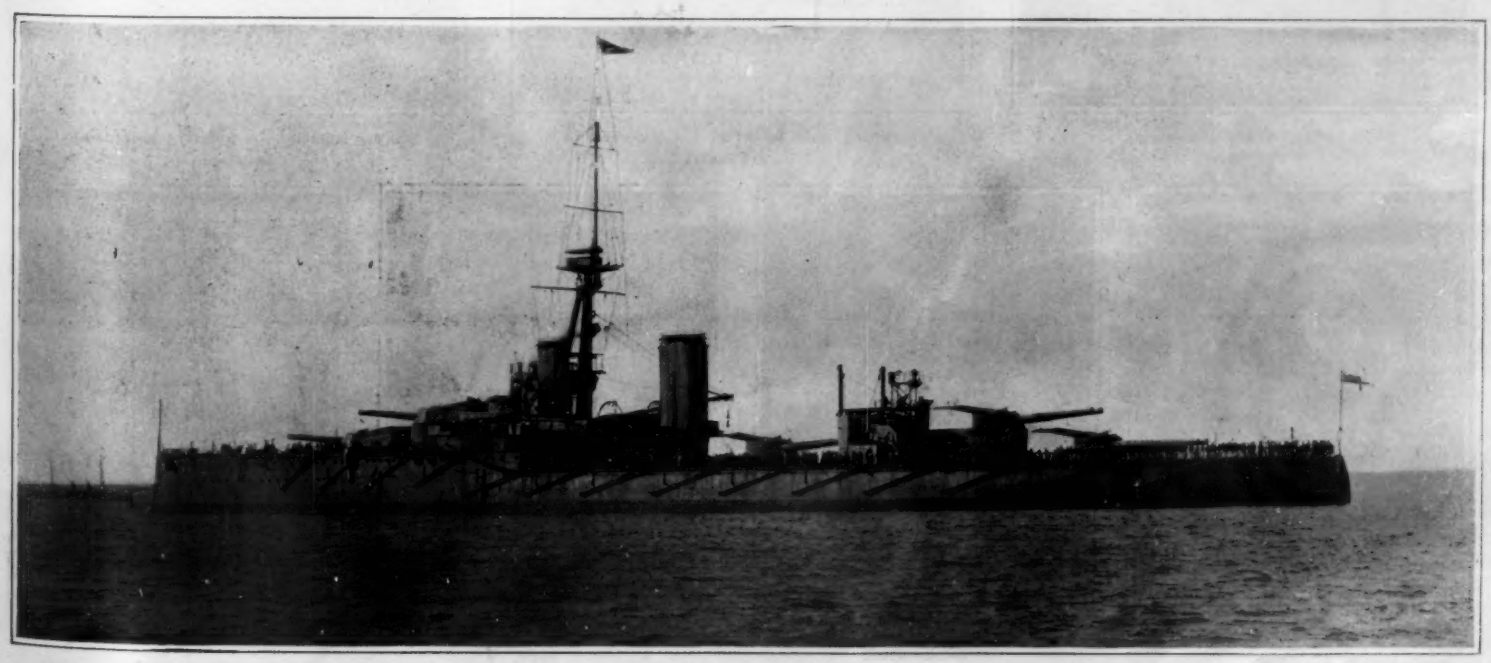
THERE are many points of interest to be noted in connection with the completion of the British battleship "Orion," which, having completed her trials, is now being prepared for commission. In the first place, the "Orion" is the first completed vessel to mount the new 13.5-inch 76-ton gun. Secondly, she is the first British ship of the all-big-gun type to carry her five turrets on the middle line. Thirdly, she is the first British armored ship to exceed a tonnage of 20,000. The figure has been reached and closely approached before. Thus, the "Neptune" displaces 19,900, and the "Hercules" and "Colossus" 20,000 tons. The tonnage of the "Orion" is, however, 22,500, which is still slightly below the displacement of the German battleships "Helgoland," "Thüringen," and "Ostfriesland," now in service with the High Sea Fleet.



Outboard profile and deck plan of "Orion," showing disposition of guns and armor.

The "Orion" left for her preliminary trials on September 11th, twenty-one and a half months from the laying of the first keel-plate. No single detail of the vessel has been officially published, but the following are her principal dimensions: Length (between perpendiculars), 545 feet; length over all, 584 feet; beam, 88 feet 6 inches; mean draft, 27 feet 6 inches. The machinery is of the Parsons turbine type, the designed horse-power being 27,000 for 21 knots. On the full speed trial the contract speed was exceeded by a knot. It is interesting in this connection to note that of the eleven completed British dreadnoughts only two have failed to make 22 knots, namely, the "St. Vin-

(Concluded on page 438.)



Displacement, 22,500 tons. **Speed,** 22 knots. **Armor:** Belt 12-inch, turrets 12-inch. **Armament:** Ten 13.5 inch and twenty 4-inch guns.

British battleship "Orion"—first of the super-dreadnoughts.

Simple Tests for Food Purity

What the Housewife May Do to Detect Adulterations

By S. Leonard Bastin

FROM time immemorial the freshness or otherwise of an egg has been a perplexing problem to the housewife. Even at the present time it is probable that the majority of people do not know how to tell whether an egg is good enough until they have broken it. This is strange inasmuch as the method of finding out the condition of eggs is so simple that anyone can follow it; moreover, the test given is one which is relied upon by the trade and may therefore be taken with confidence. All that is necessary in order to carry out the experiment is a dark room in which a candle has been placed. Now take the egg and hold it up between the eye and the light. A new-laid or very fresh egg will show clearly an air space in the larger end between the shell and the lining membrane. If the egg is really new laid this should be very small, for it tends to increase as an egg is kept. All the rest of the surface shown should present a homogeneous and translucent appearance; if the article is positively bad, a number of dark spots will be visible. A glance at the accompanying photographs will readily give an idea of the two qualities. Once the test has been performed there is no reason why anyone should ever be taken in over the egg question. There is little doubt that milk, especially in towns, is still subject to the time-worn practice of adulteration with water. If skillfully done this is not very easy to detect if the mere appearance of the liquid is considered. There is one very simple test which will tell us at once whether the milk is of a good quality and rich with a proper amount of cream. Take a sample of the milk and place it aside in a receptacle; a small tube is good for the purpose. Stir the milk well and then take a thick bright knitting needle. Plunge this to a depth of several inches into the milk and hold it steadily slanting downward. If the milk is of a rich quality the fluid will slowly gather in a drop at the end of the needle and this will remain, for rather a long time. On the other hand, supposing water has been added the drop will hardly form at all, and even if it should it will not stay but will quickly fall. Poorly fed cows on occasion will give a milk which is so lacking in cream that it will not pass the test under mention. It cannot, therefore, always be said that the milk has been fraudulently watered, although in any case where the result of the experiment shows a poor article it would be well to change one's milkman.

It is idle to deny that there is a great deal of "butter" sold which if it is not margarine, is an indifferent substitute of doubtful composition. Of course, pure margarine, made as it is from vegetable oils, is at any time better than poor quality butter, although there is of course nothing like the genuine article, on nutritive grounds. Happily it is not a difficult matter to distinguish between margarine and all other butter substitutes, and the pure article. The so-called "spoon" test has been commonly employed by analytical chemists for a long while, and is very reliable. A sample of butter two or three times the size of a pea is placed in a large spoon and heated over an alcohol burner, or if this is not available an ordinary lamp or gas burner will do as well. Good fresh butter will boil very quietly, producing a number of small foamy bubbles. On the other hand, margarine and most examples of made-up butter will crackle and splutter, making a noise very similar to that which is caused by the placing of a green stick on a hot fire. Still another point of distinction is to be noted if a portion of the sample be placed in a bottle and this is placed in water warm enough to melt the butter. If this is kept warm for half an hour the fat will either be cloudy or entirely clear. In the former case the material is certainly margarine or at any rate not pure butter; in the latter instance however, the article may be adjudged to be of a high standard of purity and freshness. Some of the cleverly made process-butters which are on the market do not always give very definite results but a little study of the matter will enable the experimenter to judge the extent of the adulteration of which he is the victim.

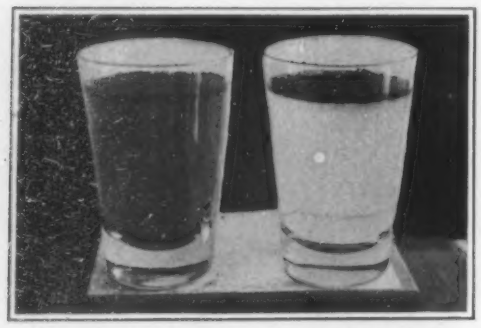
Of the commonly used breakfast beverages there is little doubt that coffee is the most widely adulterated. Fortunately, again, there are some simple tests by means of which anyone may determine the character of the article which he buys. When the admixture of foreign matter is carelessly done an examination of the grains with a powerful magnifying glass will be sufficient. Absolutely pure coffee should give an entirely uniform appearance, but the presence of adulterants which may take the form of ground peas, beans or a host of other articles is readily observed. Chicory, which of course may have been openly employed is recognized by its dark and gummy grain; this is very

(Continued on page 459.)

How a bad egg looks in the candle test.

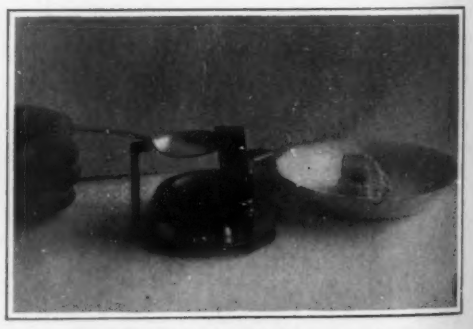
An unsafe package—blown out at the top.

The air space in a new-laid egg.



Pure coffee floats, adulterations sink and color the water.

Testing jelly to detect the presence of glucose.



Pure butter boils quietly; margarine sputters.

Testing pickles in diluted ammonia to find copper.

If it thickens, the cocoa is adulterated.

The candle test for eggs.

A knitting needle makes a good milk tester.

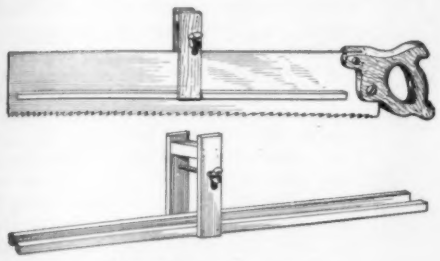
SIMPLE TESTS FOR FOOD PURITY.

Suggestions for the Workshop

Ingenious Expedients of Resourceful Mechanics

Depth Gage for Saws

IT is frequently necessary to make a saw cut of uniform depth, and unless a special device is provided for the purpose the task is an extremely difficult one. The accompanying illustration shows a small gage which may be applied to any saw and may be adjusted thereon to prevent the saw from cutting deeper than desired. Two thin strips of wood of about the

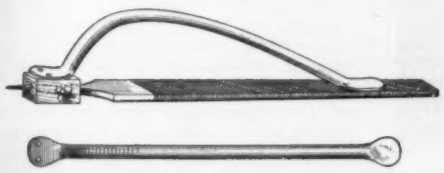


Depth gage for saws.

length of the saw blade are fastened to a pair of arms secured to a block at the upper end. A thumb screw below this block may be tightened to clamp the two strips against the blade of the saw. These strips may be secured at any desired point on the blade, and thus provide an easily adjustable depth gage.

A Simple Holder for Files

THE principal difficulty of filing a smooth surface lies in the tendency to rock the file because the handle is located at the end. This tendency can be overcome to a large extent by fitting the file with a handle such as here illustrated. The handle may be made of a round iron rod, a quarter of an inch in diameter, with the ends heated and flattened, as shown. In one of the flattened ends two small holes should be drilled to receive the screws with which the device is secured to a block of oak three-fourths



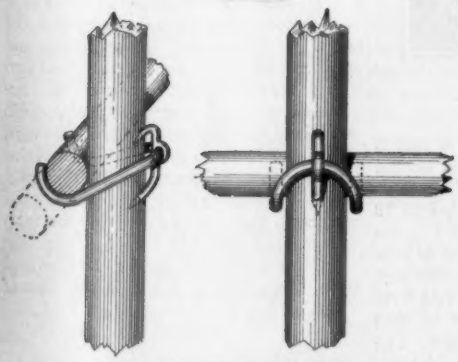
Holder for flat filing.

inch square and 2½ inches long. A hole should be drilled through the center of the wood to receive the shank of the file, and a thumb screw may be used as a set screw, to retain the file in the block. The rod may now be bent, as illustrated, to form a convenient handle, with the free flattened end bearing against the file surface.

With an arrangement of this sort the pressure of the hand is better equalized and it will be found easier to file a perfectly smooth surface.

Scaffold Dogs

IT is always more difficult to make a scaffold with round timbers than with square timbers, for the reason that there is no solid bearing offered in the former case. In order to make the scaffold secure special treatment is required. A simple device for hold-

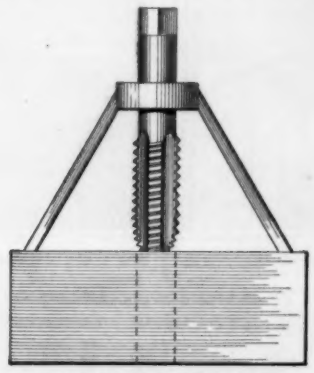


Scaffold dogs for round timbers.

ing two round timbers together is pictured herewith. It consists of a U-shaped piece of round iron, with its free ends bent upward. This U-shaped piece is fitted round the upright timber, while the horizontal timber is supported in the cradle formed by the two ends. Before applying the hook, a dog is threaded upon it. This dog is provided with a tooth at each end, adapted to dig into the vertical timber and hold the hook at the desired position. The greater the weight on the hook the more firmly will the teeth of the dog be embedded into the wood. At the same time, the hook may readily be removed when it is desired to take down the scaffold.

A Tapping Guide

THE engraving herewith shows a handy little device for tapping holes straight. The hole in the device is made large enough to take a half-inch tap and a bushing may be made to suit the bodies of taps from half inch to one-quarter. As soon as the point



Guide for straight tapping.

of the tap has entered the hole the operator can see if the tap is being held square with the work. After the tap has entered the hole far enough to guide itself the guide is removed so that the hole can be tapped out deeper.

Ball-turning Device

By H. D. Chapman

THE ball-turning device illustrated in the accompanying drawings was designed to meet a special order for a large number of ball connections. A number of methods of doing the work were tried, but in every case the balls were not perfectly spherical and it was necessary to lap them in their seats. The final solution of the difficulty was that shown in the drawings. The ball connection *A* (Fig. 1) was caught in the lathe chuck. The compound rest of the lathe was removed and a worm wheel substituted. This had a

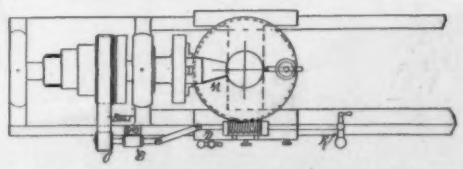


Fig. 1.—Plan view of the ball-turning attachment.

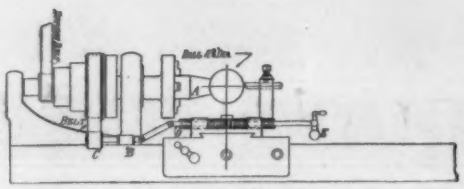


Fig. 2.—Side view showing the tool mounted on the worm wheel.

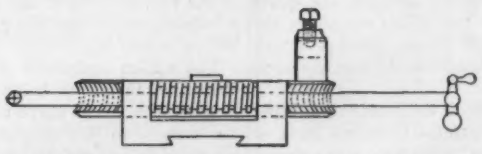


Fig. 3.—The worm gear and tool post.

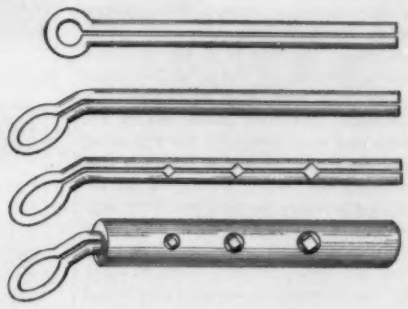
pin in the center, which was fitted to the counterbore of the cross slide. The worm wheel was also supported by means of poles which fitted in a circular T-slot, though not so tightly as to prevent the wheel from revolving upon the center pivot. A tool post was mounted on the worm wheel, and in this the tool was carried.

The worm wheel which carried the tool was turned by a worm mounted on a shaft *D*, which was rotated by means of a belt *C* driven from the cone pulley of the lathe. The shaft *D* was connected to the pulley shaft by means of universal joints, as shown clearly in Figs. 1 and 2. After a cut was taken the tool was advanced to a new position by a turn of the handle *E*. The balls turned in this manner were found to be perfectly true.

Screw-driver Wrench and Tap Wrench

By G. H. Ander

THE writer is frequently called upon to repair the "reversers" of electric locomotives, and in order to do so it is necessary to remove screws which are so located as to be inaccessible to an ordinary screw driver. The screws are locked by denting the edges with a center punch so that they will not readily become unscrewed. Furthermore, they are so arranged that there is no way of securing a grip upon them with a small monkey wrench or a Stillson. Under these conditions, the writer found it necessary to make a special tool from a cotter pin about five or six inches long. The eye of the pin was flattened out,



Screw-driver wrench and tap wrench.

so as to receive the blade of a screw driver and the pin was bent to the shape shown in the illustration. In order to make the tool of further service, several notches were cut in the adjacent edges of the pin, so as to fit taps of different sizes. These notches were made with a file, while the pin was split open for the purpose. A quarter-inch iron pipe was then fitted over the pin and holes were drilled in the pipe mating the notches in the pin. The result was a combination screw driver wrench and tap or reamer wrench. The drawing illustrates successive stages in the evolution of the tool.

A Needle Drill

By Philip Edelman

THE accompanying figure illustrates a simple way to make small drills. Insert a common needle in a small chuck, and file or break off the point. These home-made drills are excellent for all kinds of wood, and will cut thin lead and unglazed porcelain. The handy man will welcome them as an aid in starting small screws in hard wood and for many other uses.

A needle drill.

Workshop Notes

Solder for Soft Metal.—The following method will be found very handy for soldering soft metal at low temperature: Add three drops of mercury to each one-half ounce of solder. The solder will then fuse at a low temperature.—H. D. C.

Drilling Compound.—In drilling tool steel such as dies, use a compound made of one pound common soda to four quarts of water, and one quart machine oil. Let it stand for about one-half hour, and it will be ready for use.—A. C.

To Remove a Broken Amber Pipe Stem.—When an amber pipe stem is broken off, the amber part of the stem is very likely to stick in the bone sleeve, and if one attempts to take it out by force, the bone sleeve will probably be twisted out of the neck of the pipe. To overcome this difficulty, soak the broken stem and sleeve in alcohol. This will soften the amber stem slightly, and it can then easily be unscrewed from the sleeve.—H. M. NICHOLS.

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

An Automatic Mail Exchange System.

FEW, if any, of the readers of this magazine have failed to notice the crude apparatus in use at our small railway stations by which a single pouch of mail is delivered to a flying train, but it is doubtful whether many realize that this mail exchange system has been the subject of more discussion among government officials, more study upon the part of inventors and the source of greater loss and annoyance to all concerned than almost any other piece of mechanism in the public service.

Since 1869, when the first iron catcher arm was put into commission, practically no improvement has been made in the mail exchange system in use upon our railroads.

Hardly had the mail catcher's arm of 1869 been put into commission than all connected with the service realized its inefficiency. Failure to collect or deliver the mail led to numberless petty quarrels between mail clerks and station employees. Frequently pouches thrown from passing trains or knocked from the cranes were sucked under the wheels of the cars and ground to powder. Worst of all, accidents to engine men and other employees who inadvertently put their heads out of the windows and were struck by the extending arms of the crane became so common that many inventers became interested in the subject. Plans by the hundred were suggested but few departed materially from the old design and all proved a failure when put to the test. Disappointed at their failure, the government retained the use of the former apparatus and accidents to employees and mail continued increasing rapidly as the service was extended.

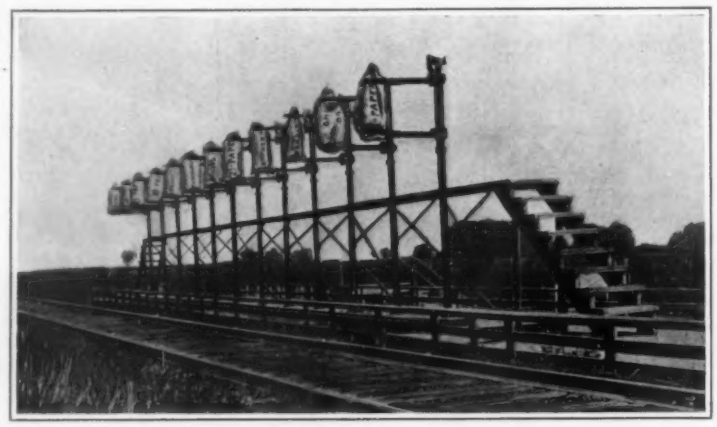
To-day there are more than 12,000 stations in this country where catcher service is in operation. This service is maintained at enormous expense because of the hand labor involved.

Recently a western traveling man has developed a mail exchange system that is completely automatic. Either the compartment pattern or the full sized mail car, as now used in the railroad mail service, can be equipped with the new exchange system. The car equipment consists of a receiving arm or chute attached to the sides of the car door and folded when not in actual use, so that it extends but two inches from the side of the car. Running upon rollers in a false floor between the doors of the car is a steel delivery truck, capable of handling more than one thousand pounds of mail matter and arranged to dump its contents upon a special platform at an appointed spot along the track. The platform slants away from the track to prevent the pouches from piling up as they are deposited and a low railing surrounds it to overcome the possibility of the pouches rolling under the wheels of the train.

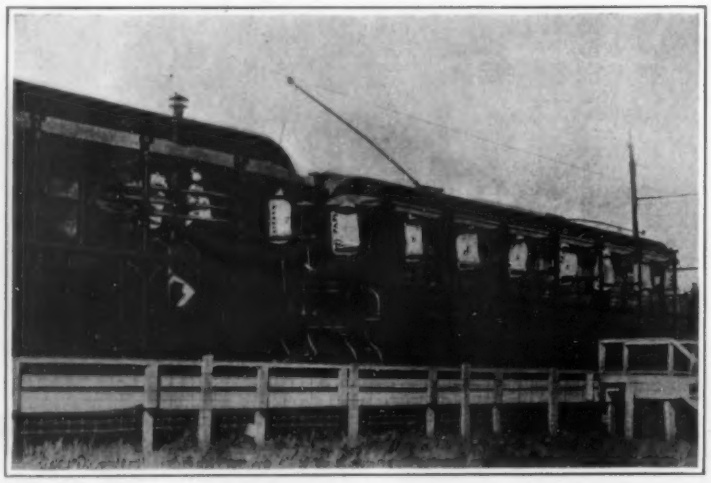
The station equipment consists of from one to twelve steel station cranes as required, and one receiving platform as just described. Located at the side of the track, 444 feet from the receiving platform, is a trip which comes into contact with its counterpart upon the mail car as the train passes. A worm gear attached to the middle of one of the axles of the mail car runs a driving shaft provided with a clutch. This clutch throws the mechanism into gear when one of the car trips attached to it comes in contact with the trip located along the side of the trackway, as the car passes it. The mechanism makes one revolution and then automatically throws itself out of gear. The first quarter of the revolution rings a gong in the car to notify the mail clerk that an exchange is to be made and opens the car door; the second quarter pushes out the delivery truck until it dumps the mail and opens the receiving chute; the third quarter holds the delivery truck in position while it dumps the mail and the receiving chute in position until the station cranes are passed and the mail upon them is conducted into the car; the fourth quarter pulls the delivery truck back into the car in the position it occupied before the mechanism was tripped, folds the receiving chute into its original position and closes the door of the car. This completes the exchange and the device remains out of gear until again tripped at the next exchange station.

Mail being taken from the station cranes.

The truck delivering mail at a station.



A battery of station cranes loaded with mail.



Exchange of mail with a passing train.

The operation of the mechanism being reduced to an exact mathematical basis, or ratio, where, in a movement of one degree of its revolution equals four feet of travel on the rails by the car wheels, the exchange must be positive. An adjustment is provided to take care of the different sizes of car wheels, wear, etc. Being geared to the axle, the mechanism runs fast, slow, forward or backward as the car runs, and if, for any reason, the car is stopped and backed up after passing the trip, and before the exchange is completed, the mechanism is turned backward with it. When started forward again it would bear the same relation to the car wheels as before. At terminals of the road the device can be quickly reversed and the receiving chutes changed to the opposite side of the door so that it is unnecessary to turn the mail car around for the return trip.

The station equipment is limited to 12 cranes but instead of being obliged to use pouches of a special shape and size as with the present catcher system, pouches and tie sacks, of any weight from an empty to the heaviest in the service, may be used and any class of mail handled in them. The delivery of mail is only limited by the number of mail cars in the train, as each car can deliver upon the platform the full capacity of its delivery truck, as required. All the former danger to engineer or passengers from being struck by the crane arms is eliminated in the new steel cranes which, when set for action, stand 30 inches from the side of the car. The extending arms of the crane are equipped with clamps for holding the pouches and are so protected that the pouches can be inserted into them in but one way, which insures the proper operation of the system. When relieved of their burden, the crane arms automatically swing to a parallel position with the track where they remain until set for the next exchange.

For example, either part of the system may be made to work by itself so that if there is no collection to be made at a station the delivery of the mail only takes place, and *vice versa*. If no exchange whatever is to take place the mail clerk merely throws the mechanism out of gear with a lever. Human memory is sometimes tricky, however, and the mail clerk may forget to throw the mechanism out of gear before the station is reached. The gong rings and the device begins to operate. The mail clerk upon being reminded of his mistake, quickly throws the reversing lever and the mechanism runs backward and throws itself out of gear.

Accommodations have also been made for the turning of the trucks on sharp curves by the use of knuckle and slip joints, so as not to interfere with the operation of the device, and the parts beneath the floor of the car are protected from injury by water, ice and snow or from flying stones and gravel of the roadbed.

This mail exchange system has been tested hundreds of times at Overland Park, Kan., a suburb of Kansas City, in the past year. Exchanges averaging 450 pounds of mail on each trip have taken place at speeds varying from 5 to 40 miles an hour. Not one failure of the device has occurred nor a single damage to pouches or equipment thus far, and as a result of exhibitions of its operation, made in the presence of government officials, permission has been granted by the Post Office Department to use the automatic exchange for handling mail to test its practicability in the regular service. It now remains for each individual road to relieve itself of the expense, delay and danger to its employees which are inherent qualities of the present mail exchange system.

George Washington on Rumsey's Steamboat

ONE of the earliest contests involving priority of an invention was the contest of James Rumsey to the claim of John Fitch to the steamboat invention and Mr. Rumsey had no less a witness in his behalf than George Washington, who, in an indorsement forming a part of the records of the case, says:

"I have seen the model of Mr. Rumsey's boat, constructed to work against stream, examined the powers upon which it acts, been eye-witness to an actual experiment in running water of some rapidity, and give it as my opinion (although I had little faith before) that he has discovered the art of working boats by mechanism and small manual assistance against rapid currents; that this discovery is of vast importance, may be of greatest usefulness in our inland navigation; and if it succeeds, of which I have no doubt, that the value of it is greatly enhanced by the simplicity of the works, which, when seen and explained, may be executed by the most common mechanic.

"Given under my hand at the town of Bath, County of Berkeley, in the state of Virginia, this 7th of September, 1784.

"GEORGE WASHINGTON."

Priest's Invention of a Fire Extinguisher

INTERESTING accounts are received from abroad concerning tests of a fire extinguisher understood to be the invention of a priest who has been decorated by

LEGAL NOTICES

PATENTS

If you have an invention which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of more than sixty years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to PATENTS, TRADE MARKS, FOREIGN PATENTS, etc.

All patents secured through us are described without cost to the patentee in the SCIENTIFIC AMERICAN.

MUNN & COMPANY
361 BROADWAY, NEW YORK
Branch Office, 625 F Street, Washington, D. C.

PATENTS SECURED OR FEE RETURNED
Free report as to Patentability. Illustrated Guide Book, and What To Invent with List of Inventions Wanted and Prizes offered for inventions sent free. VICTOR J. EVANS & CO., Washington, D.C.

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

BUSINESS OPPORTUNITIES.

TO INVENTORS—Large manufacturing concern with a trained selling force covering the whole country will manufacture and market on a royalty basis any article that can be sold by sample at a large profit and for which a large demand can be created. Address with full description: Machinery, P. O. Box 539, Boston, Mass.

A BERLIN PATENT ATTORNEY desires to enter into negotiations with a competent and absolutely reliable young representative resident in Washington, with a view to mutual co-operation in patent cases. Offers, with references, to be addressed to "Berlin Patent Attorney," care of this journal.

FOR SALE.

LOCAL REPRESENTATIVE WANTED.—Splendid income assured right man to act as our representative after learning our business thoroughly by mail. Former experience unnecessary. All we require is honesty, ability, ambition and willingness to learn a lucrative business. No soliciting or traveling. This is an exceptional opportunity for a man in your section to get into a big paying business without capital and become independent for life. Write at once for full particulars. Address E. R. Marden, Pres., The National Co-Operative Real Estate Company, L 378 Marden Building, Washington, D. C.

PATENTS FOR SALE.

FOR SALE.—Pat. No. 1,005,587, Bed Bug Trap, neat, clean and easy way of forever ridding a home of bed bugs at small expense, nothing on the market like it, will be a sure winner W. H. McDonald, Pima, Arizona.

STRAIGHT OFFER.—For sale, U. S. Pat. No. 92,005 and Canadian Pat. No. 129,415 for a New Chain Grate (travelling grate) with automatic draught regulation. Increased efficiency. Address H. Flössel, Kiel, Germany.

MALE HELP WANTED.

WANTED.—PAY OR BOARD AT START TO learn trades, Automobiles, Electricity, Bricklaying, Plumbing, by actual work on jobs. Only few months required. No apprenticeship drudgery. 200 students last year. Catalogue free. United Trade School, Dept. S, Los Angeles, Cal.

TYPEWRITERS.

CLEARANCE SALE—Remingtons, Densmores, Manhattans, Jewetts, $11.50 ea., Franklins, Hammonds, $9 ea. Bargains in Underwoods, Smiths, others; all guaranteed. Standard Typewriter Exchange, 23 Park Row, N. Y.

WANTED.

WANTED.—One second-class laboratorian at $3.52 per diem. A competitive examination will be held November 27, 1911, at the Navy Yard, Washington, D.C., for filling the above position. For further information address "Commandant, Navy Yard, Washington, D.C."

MISCELLANEOUS.

Chemical Analyses, Assays, Microscopical tests, etc. Investigations and advice in all chemical questions. 11 years experience. Parobek Chemical Laboratory, 362 South Broad Street, Trenton, New Jersey.

FREE TUITION BY MAIL.—Civil Service, Drawing, Engineering, Electric Wiring, Agricultural, Poultry, Normal, Academic, Bookkeeping, Shorthand Courses. Matriculation $5. Tuition free to first applicants. Apply to CARNEGIE COLLEGE, ROGERS, OHIO.

FREE—"INVESTING FOR PROFIT" Magazine. Send me your name and I will mail you this magazine absolutely free. Before you invest a dollar anywhere—get this magazine—it is worth $10 a copy to any man who intends to invest $5 or more per month. Tells you how $1,000 can grow to $22,000—how to judge different classes of investments; the Real Earning Power of your money. This magazine six months free if you write to-day. H. L. Barber, Publisher, 425, 28 W. Jackson Blvd., Chicago.

INQUIRY COLUMN

Inquiry No. 9255.—Wanted, to buy a patent roller, a ball-bearing axle, which could be purchased on a royalty basis; it must be cheap and fully proved.

Inquiry No. 9256. Wanted addresses of parties having Pitchblende deposits, if able to ship ore.

Inquiry No. 9257. Wanted addresses of firms selling second-hand water turbines.

Inquiry No. 9258.—Wanted addresses of parties having gem materials to offer in any part of the world.

Inquiry No. 9259.—Wanted to buy a machine for removing the coating of a filbert.

Inquiry No. 9260.—Want addresses of parties able to ship corundum, garnet, flint, emery or any material suitable as an abrasive.

the French Government. In describing the invention in a report published by the Bureau of Manufactures, Consul-General Griffiths of London, says:

"Two cylinders are used, one of which is small and charged with 'ignifuge' gases which by connecting tubes are used to expel the solution from a much larger cylinder through an ordinary nozzle. The compound is described as follows:

"1. A mixture of ignifuge gases, which, as a physical agent, utilizes its elastic force to project a liquid impregnated with salts and as a chemical agent renders the gases of the atmosphere which burn in every fire incombustible.

"2. An effervescent liquid, in which are found salts in a state of solution. These salts, unknown before, were obtained by the Abbe D. Daney through electric furnaces of 3,000 to 5,000 amperes. When projected they produce other extinguishing gases which increase the effect of the ignifuge gases referred to above. When reaching the blazing material they cover it with a peculiar dustlike coat, which makes it fireproof."

Notes for Inventors

False Prophets.—In the face of the enormous increase in the issue of patents from year to year, it is recalled that forty years or more ago an examiner in the division of agricultural implements of the Patent Office announced dogmatically that plows had been perfected and that no more patents would be granted for plows. About the same time an attorney engaged in soliciting patents declared his intention of going out of the business since about everything had been patented that could be.

A Laminated Rail-joint.—In a patent (No. 1,005,146) John A. Bodkin of New York city shows a splice bar forming the fish plate of a rail-joint and composed of a series of long, thin plates lying side by side and increasing gradually in width throughout the series so that their edges may coincide with one another and also with the outer edges of the base and ball of the rail.

Another Safety Device for Aeronauts.—A safety device, patented (No. 1,005,569) by Auld Weinberg De Meir of Providence, R. I., takes the form of a garment whose body portion is provided with exterior air chambers. The air chambers are arranged in superposed rows extending around the garment and open at the bottom and have a vent at the top and are adapted to perform the function of a parachute.

A Reversible Glove.—A reversible glove, which has oppositely disposed inserts, one of which forms the back of one finger and the other the front of another finger, is shown in patent (No. 1,005,437) granted to Charles H. Leavengood of Coshocton, Ohio, assignor of one-half to John A. Hesket of the same place.

A Dressing for Felt Hats.—Large fortunes have been made out of dressings and polishes for men's shoes. The men who wear shoes also wear hats, and these are oftener discarded because they lose their color than because of wear. Will not some one invent a dressing, it may be in the form of a dye, easily applied to a hat, and serving to freshen it up and improve its appearance? Possibly the dressing would have to be applied in some original way, but this can, doubtless, be devised by one experienced in the manipulation of felts, and it should be of such a character as to be easily and effectually handled by the ordinary wearer.

A Safety Apparatus for Mines.—The mine safety apparatus, provided in patent No. 1,005,196, to Maturen Gold of Hayward, Okla., and William A. Montgomery of Loland, N. M., provides a system of pipes in a mine and provided at intervals with taps, a blower for forcing air through the pipes and a helmet with an air vent and with air inlet pipes with couplings which may be connected with the taps of the main pipes. The apparatus also includes a water pipe provided with means for distributing water at different points within the mine.

The Goodyear Ideal of a Winter Tire

No-Rim-Cut—
10% Oversize—
With a Tough,
Deep-Cut,
Double-Thick,
Non-Skid
Tread

The Most Popular Tire

Goodyear No-Rim-Cut tires have suddenly come into dominant place in America.

The sale has thrice doubled in the past two years. Our last month's record shows a gain over last year of 343 per cent.

No-Rim-Cut tires are now outselling any other type of tire. Over 700,000 have been used to date. And for next year's demand we have increased our capacity to 3,800 per day.

Saving Half

The reasons are these:

These patented tires make rim-cutting impossible. Not an instance of rim-cutting has ever occurred in the 700,000 sold.

With the old type tire—the clincher tire—statistics show that 23 per cent. of all ruined tires are rim-cut.

This worry and expense is ended forever with users of Goodyear No-Rim-Cut tires.

Then No-Rim-Cut tires are 10% over the rated size. That means 10% more air—10% greater carrying capacity. And that, with the average car, adds 25% to the tire mileage.

This extra size takes care of the extras added to a car. It avoids the blowouts due to overloading.

These two features together—No-Rim-Cut and oversize—under average conditions cut tire bills in two. That has been proved tens of thousands of times. Yet No-Rim-Cut tires now cost no more than other standard tires.

That is why this tire—our patented type—has become the leading tire of America.

The Thousand-Grip Tread

Now these tires, if you wish, come fitted with an ideal Non-Skid tread.

Not flimsy projections cut in the regular tread. Not metal and rubber, which never combine.

This is an extra tread, made of very tough rubber, vulcanized onto our regular tread. Thus it gives you a double-thick tread.

The extra tread is immensely wear-resisting. It is so thick that the blocks can be cut very deep. It is almost proof against puncture.

The deep-cut blocks grasp the road surface with countless edges and angles.

Each block widens out at the base, so that the strain is distributed just as widely as it is with a smooth-tread tire.

There has never been invented a device against skidding which compares with this Non-Skid tread.

Note its thickness. Note its edges and angles. Judge for yourself its irresistible grip. In wet and wintry weather safety requires this tire.

GOODYEAR
No-Rim-Cut Tires
With or Without Non-Skid Treads

Our Tire Book, based on 12 years of tire making, is filled with facts you should know. Ask us to mail it to you.

The Goodyear Tire & Rubber Co.

First Street, - Akron, Ohio

Branches and Agencies in 103 Principal Cities

We Make All Kinds of Rubber Tires, Tire Accessories and Repair Outfits

Main Canadian Office, Toronto, Ont. Canadian Factory, Bowmanville, Ont.

(422)

Supplements Hammer and Nails

You can't nail down everything—some pieces of wood you can't drive a greased nail through without splitting them.

There's where you need a tube or bottle of

LEPAGE'S GLUE

Has a holding strength per sq. inch equal to that of three six-penny nails driven 1½ inches into solid oak.

Applied direct from tube or with metal spreader from our solid cap bottles.

Always ready for use, for it absolutely can't dry out unless you leave the cover off.

Get a tube or bottle today and write for free booklet, "Glueism," which gives 101 useful ways to use this neat, quick, strong adhesive.

RUSSIA CEMENT COMPANY

We manufacture Glues (hard or liquid) in bulk for industrial purposes

66 Essex Ave., Gloucester, Mass.

Library Slips with every Bottle and Tube.

FREE SAMPLE Goes With First Letter

Something new. Every firm wants it. Orders $1.00 to $100. Big demand everywhere. Nice pleasant business. Write at once. METALLIC SIGN CO., 438 N. Clark, Chicago

TRADE MARK
EVERSTICK
INVISIBLE RUBBERS

Can be worn all day long, without discomfort, they protect where protection is needed, the sole of the shoe.

EVERYBODY NEEDS EVERSTICKS.

Always for sale where good shoes are sold.

ACCEPT NO SUBSTITUTES.

THE ADAMS & FORD CO.
CLEVELAND, O.

None genuine without THIS cord.

Jaeger
SANITARY GOODS

The celebrated Jaeger Underwear is suitable alike for men, women and children, and for all conditions of health and occupation. Recommended by the Medical Profession everywhere.

Explanatory catalogue and samples free on request.

Dr. Jaeger's S. W. S. Co.'s Own Stores
New York: 306 Fifth Avenue, 22 Maiden Lane. Brooklyn: 504 Fulton St. Boston: 228 Boylston St. Philadelphia: 1516 Chestnut St. Chicago: 126 N. State St. *Agents in all Principal Cities.*

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of General Interest.

PARASOL AND UMBRELLA COVER.—J. W. LEWIS, 124 Lower Terrace, San Francisco, Cal. The object here is to provide an umbrella, parasol or like article with interchangeable covers, so that with a single frame a number of covers with different color or material may be used, and so that the life of the umbrella may be prolonged indefinitely by replacing the covers when worn.

ASH HOLDER FOR CIGARS.—CHARLES F. HOOFER, 324 Chemical Block, Spokane, Wash. The object of the invention is to provide what may be termed a clip-cap safety cigar smoker; and the intention is to provide a cap adapted to fit and be self-retaining on the burning end

ASH HOLDER FOR CIGARS.

of a cigar and to retain the ashes and prevent the same from falling while the cigar is being smoked or held in the hand. The safety cap is foraminous to afford passage of air and is preferably made with a screen body of fine mesh wire or other material in the form of a cone and the inner or butt end of the cap is adapted to grip inwardly upon a cigar. A perspective view of the invention is shown in the engraving.

Electrical Devices.

ELECTRIC ELEVATOR BRAKE.—VOLNEY W. MASON, Providence, R. I. The larger illustration shows the application of the brake to the right and left driving shaft of the electric motor on which are two worms, which mesh into two worm gears on the hoisting drum shafts. On the extreme left is the square frame supporting the rheostat for varying the strength of the electric starter. The driving shaft is coupled directly to the motor shaft by a flanged coupling which also forms a brake pulley. The brake arms are suspended at their upper ends from a stud supported upon an inverted V-shaped frame rigidly attached to the base block. The brake arms extend downward below the brake pulley in a straight line, in which are longitudinal slots. The transverse horizontal operating brake lever is pivoted to a stud stand in the space between end portions of the brake arms as shown in the small illustration, and carries friction rollers on the two stud bolts shown on each side of the central stand, which are free to move vertically within the slots. The left end of the lever is attached to the lower end of a solenoid operating vertically within an electro-magnet, the latter being shown with its connecting wires to the right of the hoisting drum in the large illustration. In the diagram view the operating lever is shown drawn up by the solenoid of the electro-magnet in this position while the current is on, which holds the brake arms as well as their brake surfaces apart away from the brake pulley. When the operator in the elevator breaks the circuit by the usual switch the solenoid drops also the operating lever by its weight and an adjustable weight attached thereto, bringing the lever into an inclined position (shown by the dotted line) which causes the brake arms to clamp the brake pulley and stop movement of the motor shaft as well as that of the elevator. The general construction of the frame (in the large engraving) embodies means of adjustment not usually found in machinery of this class, all the parts being very accessible and convenient in erection or removal in case of repairs.

Hardware and Tools.

PLATE LIFTER.—JOSEPH E. WENMAN, New Philadelphia, Ohio. The accompanying picture represents the plate lifter in a perspective view. The invention relates to a form of lifter or detachable handle for articles, especially those which are too hot to be readily handled without the interposition of some such tool. The object is to provide a utensil having

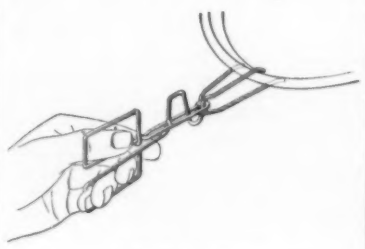


PLATE LIFTER.

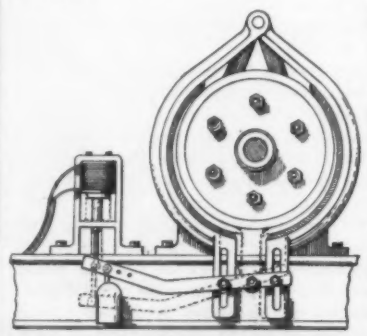
parts, which may readily be constructed from metal wire without the use of any connecting pivots. The relative parts are so constructed that they may be mutually traced, and the parts are so constructed that they may be readily and removably locked in position. In the construction each member is made continuous of one length of wire, and there are no drilled joints.

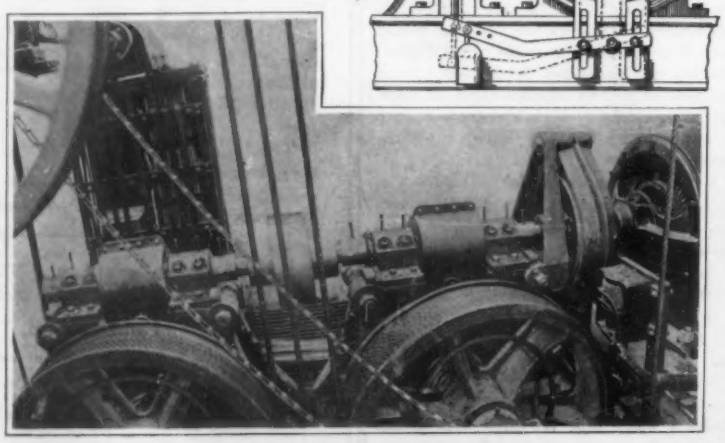
FISH GRIP.—J. DITTMAR, 180 Hamburg Avenue, Brooklyn, New York. In this patent the object of the inventor is to provide a fish grip for the use of fishermen, fish dealers and other persons, and arranged to permit of obtaining a firm hold on a live fish when taking it off the fish hook, or out of a net or for holding a fish for scaling, cleaning or other purposes.

Machines and Mechanical Devices.

RULE CUTTING MACHINE.—J. A. RICHARDS, Albion, Mich. This machine is adapted for cutting bent rules as well as straight ones. When a bent rule is to be cut, the shelf or gage-bar, which serves as a support for straight rules while being cut, is raised and swung back out of the way, which allows due access to the cutting mechanism so that the bent rule may be manipulated in the required manner.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.





ELECTRIC ELEVATOR BRAKE.

Use KEROSENE Engine FREE!

Amazing "DETROIT" Kerosene Engine shipped on 15 days' FREE Trial, proves kerosene cheapest, safest, most powerful fuel. If **satisfied**, pay lowest price ever given on reliable farm engine; if **not**, pay nothing.

Gasoline Going Up!

Automobile owners are burning up so much gasoline that the world's supply is running short. Gasoline is 5c to 15c higher than coal oil. Still going up. Two pints of coal oil do work of three pints gasoline. No waste, no evaporation, no explosion from coal oil. Cylinders cannot carbonize

Amazing "DETROIT"

The "DETROIT" is the only engine that handles coal oil successfully; uses alcohol, gasoline and benzine, too. Starts without cranking. Basic patent—only three moving parts—no cams—no sprockets—no gears—no valves—the utmost in simplicity, power and strength. Mounted on skids. All sizes, 2 to 20 h. p., in stock ready to ship. Complete engine tested just before crating. Comes all ready to run. Pumps, saws, threshes, churns, separates milk, grinds feed, shells corn, runs home electric-lighting plant. **Prices (stripped), $29.50 up.** Sent any place on 15 days' Free Trial. Don't buy an engine till you investigate amazing, money-saving, power-saving "DETROIT." Thousands in use. Costs only postal to find out. If you are first in your neighborhood to write, we will allow you **Special Extra-Low Introductory** price. Write! **Detroit Engine Works, 127 Bellevue Ave., Detroit, Mich.**

Solders and Soldering

¶ If you want a complete text book on **Solders** and the art of **Soldering,** giving *practical, working* recipes and formulæ which can be used by metallurgist, the goldsmith, the silversmith, the jeweler, and the metal-worker in general, read the following *Scientific American Supplements:* 1112, 1384, 1481, 1610, 1622, 1434, 1533, price 70 cents by mail. ¶ Order from your newsdealer or from

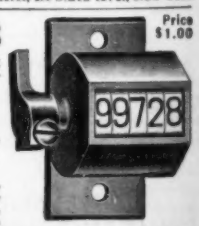
MUNN & COMPANY, *Inc.*
Publishers, 361 Broadway, New York

AGENTS—$45.00 A WEEK
Don't Throw It
MENDETS

Mend all leaks instantly in graniteware, hot water bags, tin, copper, cooking utensils, etc. No heat, solder, cement or rivet. Any one can use them. Fit any surface. Smooth. Sample box, 10c. Complete box, assrtd. sizes, 25c, postpaid. Wonderful opportunity for live agents. Write today. **Collette Mfg. Co., Box 192, Amsterdam, N.Y.**

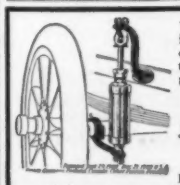
Magical Apparatus.
Grand Book Catalogue. Over 700 engravings
25c. Parlor Tricks Catalogue, free.
MARTINKA & CO., Mfrs., 493 Sixth Ave., New York

Veeder Counters
Price $1.00



to register reciprocating movements or revolutions. Cut full size. Booklet Free.

VEEDER MFG. CO.
18 Sargeant St., Hartford, Conn.
Cyclometers, Odometers, Tachometers, Counters and Fine Castings.
Represented in Great Britain by MARKT & CO., LIMITED, 6 City Road, Finsbury Square, London, E. C.; France, by MARKT & CO., LIMITED, 107 Avenue Parmentier, Paris; Germany, Austria-Hungary and Scandinavian Countries by LUDW. LOEWE & CO., Hutten Strasse 17-20, Berlin.



Why not enjoy absolute comfort in your automobile over all kinds of roads? You can accomplish this if your automobile is equipped with the

The New 1912 FLENTJE Automatic Hydraulic Jounce & Recoil Preventers

In a class by itself
"BEST IN THE WORLD"

In a short time you will save the cost of the preventers on tires and springs and engine and body of your car.

Try a set on thirty days' free trial and three years' guarantee, and be convinced of the correctness of my claims.

$5000 a side to any shock absorber manufacturer to disprove that "The Flentje" is the best in the world.

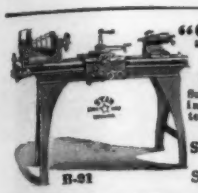
For for further particulars, apply to
ERNST FLENTJE, 1643 Cambridge St., Cambridge, Mass.
New York Branch: 1926 B'way, cor. 64th St., Room 400 N. Y. City

Sandow $37.50
2½ H.P. Stationary Engine—Complete

Gives ample power for all farm uses. Only three moving parts—no cams, no gears, no valves—can't get out of order. Perfect governor—ideal cooling system. Uses **kerosene** (coal oil), **gasoline, alcohol, distillate** or **gas.** Sold on 15 days' trial. YOUR MONEY BACK IF YOU ARE NOT SATISFIED.

5-year ironclad guarantee. Sizes 2½ to 20 H. P., at proportionate prices, in stock, ready to ship. Postal brings full particulars free. Write for proposition on first engine in your locality. (116)

Detroit Motor Car Supply Co., 162 Canton Av. Detroit, Mich.



"STAR" Large Line of Attachments
For Foot or Power LATHES
Suitable for fine accurate work in the repair shop, garage, tool room and machine shop.
Send for Catalogue B
SENECA FALLS MFG. CO.
695 Water Street
Seneca Falls, N. Y., U.S.A.
B-91

SEBASTIAN LATHES
9 to 15 Inch Swing
High Quality Low Prices Catalog Free
THE SEBASTIAN LATHE CO., 120 Culvert St., Cincinnati, O.

The "BARNES" Positive Feed
Upright Drills
10 to 50-inch Swing
Send for Drill Catalogue
W. F. & Jno. Barnes Co.
(*Established 1872*)
TRADE B MARK
1999 Ruby Street Rockford, Illinois

DO YOU USE GRINDSTONES?
If so we can supply you. All sizes **mounted** and **unmounted**, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. *Send for catalogue "I."*
The CLEVELAND STONE CO.
6th Floor, Hickox Bldg., Cleveland, O.

DIES, FINE TOOLS METAL SPECIALTIES MOORE & CO., Indiana & Franklin Sts., Chicago
SPECIAL MACHINERY INVENTIONS PERFECTED

RUBBER Expert Manufacturers Fine Jobbing Work
PARKER, STEARNS & CO.,
288-290 Sheffield Ave., Brooklyn, N. Y.

WANTED To manufacture METAL SPECIALTIES, 20 years experience in making Dies, Tools and Special Machinery. Expert work. Complete equipment. NATIONAL STAMPING & ELECTRIC WORKS Dept. 2, 412 So. Clinton Street, - Chicago, Ill.

Experimental & Model Work
Circular and Advice Free
Wm. Gardam & Son, 82-86 Park Place, N. Y.

MODELS CHICAGO MODEL WORKS
ESTABLISHED 1867 166 W. MADISON ST. CHICAGO ILL.
WRITE FOR CATALOGUE OF MODEL SUPPLIES

MASON'S NEW PAT. WHIP HOISTS
save expense and liability incident to Elevators.
Adopted by principal storehouses in New York & Boston
Manfd. by VOLNEY W. MASON & CO., Inc.
Providence, R. I., U. S. A.

Makes repairs neat and quick. Mends harness, shoes, canvas. Myers' Sewing Awl makes Lock Stitch. $1 prepaid. Big money for agents.
The Awl for All
C. A. MYERS CO., 6374 Lexington Ave., Chicago, Ill.

Models & Experimental Work
INVENTIONS DEVELOPED
SPECIAL MACHINERY . . .
E. V. BAILLARD CO., 24 Frankfort St., N. Y.

THE SCHWERDTLE STAMP CO.
STEEL STAMPS LETTERS & FIGURES.
BRIDGEPORT CONN.

ICE MACHINES Corliss Engines, Brewers and Bottlers' Machinery
The VILTER MFG. CO.
899 Clinton Street, Milwaukee, Wis.

Print Your Own
Cards, circulars, books, newspaper. Press $5, Larger $18, Rotary $60. Save money. Big profit printing for others. All easy, rules sent. Write factory for press catalog, TYPE, cards, paper, &c.
THE PRESS CO., Meriden, Connecticut

LUBRICATES ANYTHING SEND FOR SAMPLE FREE
118-124 North Clinton St.
CHESLEY & CO. CHICAGO, U.S.A.

'TIS A RED DEVIL "GIANT" NAIL PULLER
(*Same make as the famous "Red Devil" glass cutter*)
This Genuine "Giant" Nail Puller will yank a nail out in a jiffy without tearing a board to pieces.
It's one of the "Red Devil" Tool Line.
If your dealer hasn't it send us $1.50 and his name.
SMITH & HEMENWAY CO.
150 Chambers Street New York City

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12561) W. S. B. writes: In re "Musical Sands"—SUPPLEMENT, September 30th, p. 224—a good specimen exists at Manchester, Mass., where the sand of the beach next the hotel creaks audibly when walked on. A. Very true; and there used to be a sounding beach between Rockport and Gloucester, Mass., when we used to summer on that coast. The waves raised the pebbles and smaller stones, and as they fell back they gave a musical tone by their rapid blows against each other.

(12562) A. F. K. asks: 1. How much by weight and what number and kind (single or double covered) of primary copper wire is necessary for one induction coil such as is used for pump spark ignition on gasoline engines? A. For the primary of an induction coil giving an inch spark use about 50 feet of No. 14, B. & S. single cotton-covered magnet wire. Double-covered wire may be used with some advantage in insulation, but a loss from the increased space taken up by the wire. 2. How much and what number and kind of secondary wire is necessary for the same coil? A. The secondary may contain 1¼ pounds of No. 36 wire. Silk-covered wire makes the smaller coil, but cotton-covered wire is stronger mechanically. 3. Is a condenser generally used with such coils? A. A condenser is necessary. You will find all details for making coils, machinery for winding, etc., described and figured in our Collins's "Making of Induction Coils," price $3, a book every-one making a coil should have at hand.

(12563) C. M. asks: In one of your older issues I saw how to make a luminous lamp. I tried it, but it will not work. Heated pure olive oil for fifteen minutes in a small glass bottle, put in a piece of phosphorus and corked it up, but it gives off no light at all. The phosphorus sinks to the bottom of the glass. Can you tell me what is wrong? A. If you will take the cork out of the luminous bottle and shake the contents in the dark, so as to have some air from the outside enter the bottle, you will see the light, provided the oil has dissolved any of the phosphorus. The oil will not shine unless some oxygen from the air can get at the phosphorus. We have had one of these for years which still shines whenever we shake it up and bring fresh air into contact with the phosphorus.

(12564) J. T. P. asks: Can you tell if directions for making a pinhole camera have ever appeared in your publication? If so, in what number, and at what price can I get this copy? I wish to make an 8 x 10 camera. Have a book already telling how to make an apparatus to take 4 x 4 plates. This says make pinhole with No. 10 needle. Now tell me this: At what distance from pinhole should an 8 x 10 plate be, and what size needle should I make the pinhole with? Also, what is the length of exposure for plates of this size? A. In the pinhole camera the size of the plate is not directly connected with the size of the hole at all. The distance of the plate from the hole for best definition is determined by the size of the hole. We give you a table from a French writer on this subject:

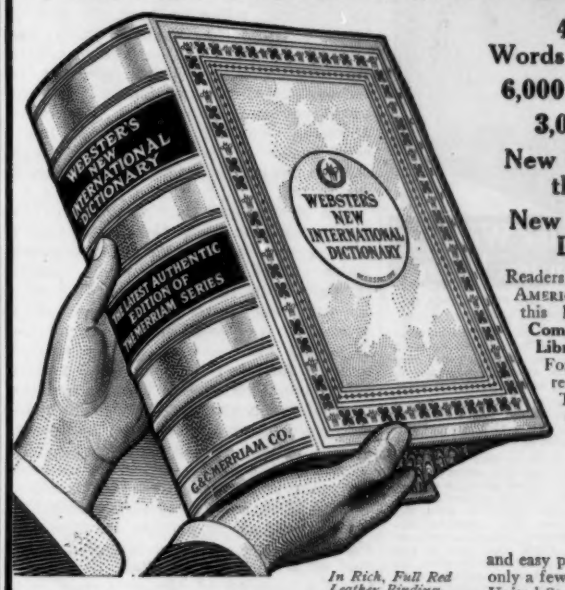
Aperture.	Distance of Plate.
0.012 inch.	4.33 inches.
0.016 inch.	7.87 inches.
0.02 inch.	11.9 inches.
0.024 inch.	17.32 inches.

The pinhole should be perfectly round, and carefully beveled on both sides, as perfect as it can be made, if you would get best effect. It will include about 170 degrees. If then you secure a wide view at a distance of 8 inches with the aperture 0.016 inch, and wish a view giving a detail of some part of this wider view, you have only to move the plate back to 17.32 inches and use the 0.024 pinhole. The same width of view is taken in by the pinhole in both cases, but at the longer distance only a small portion of the view will fall on the same sized plate. The result is an enlarged view of a portion of the former picture. A wide range of the time of exposure is possible with skill in managing the development. With the smallest pinhole given, the exposure will be at least twenty-five times longer than with a lens giving the same size of picture, and with the longer distances the exposure must be greatly increased in length, probably two hundred times for the 17.32-inch distance. You will have to work these matters out for yourself by experiment. The light is very faint when spread over a large plate, when the aperture is only 1/40 inch at the largest.

1911 Atlas Of the World Given FREE
With New Census

To the readers of THE SCIENTIFIC AMERICAN who take advantage of this **Offer** now made in connection with

Webster's NEW International
Not A New Edition A Mere Revision But a New Creation


WEBSTER'S NEW INTERNATIONAL DICTIONARY
THE LATEST AUTHENTIC EDITION OF THE MERRIAM SERIES
G. & C. MERRIAM CO.
WEBSTER'S NEW INTERNATIONAL DICTIONARY
In Rich, Full Red Leather Binding.

400,000 Words and Phrases
6,000 Illustrations
3,000 Pages
New Gazetteer of the World
New Biographical Dictionary

Readers of THE SCIENTIFIC AMERICAN can now secure this **Newest** and **Most Complete Reference Library** in Dictionary Form on the following remarkably easy terms: The entire work in full leather (with Atlas)

Delivered for $1.00

and easy payment thereafter of only a few cents a week in the United States or Canada.

WHAT EMINENT AUTHORITIES SAY

United States Court of Claims: "We consider the work a distinct advance over other dictionaries which have come under our observation."

Nicholas Murray Butler, President Columbia University: "Marks new advances even upon its excellent predecessor."

Dr. C. H. Parkhurst, New York City: "It is a marvel of completeness and an indispensable feature of the library of every man who either reads or writes."

New York Sun: "Not a word or a definition in which some change for improvement has not been made."

"To have this work in the home is like sending the whole family to college."

To those who respond at once we will send a copy of an amusing "Test in Pronounciation" (with key), entitled "The Americanization of Carver," and also a "Red Facsimile Booklet" of interesting questions, with references to their answers.

The ATLAS

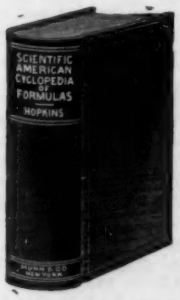
is the New Census 1911 "New Reference Atlas of the World," containing 128 pages of maps beautifully printed in colors with marginal reference indexes, besides illustrated description of **PANAMA CANAL**, all handsomely bound in red cloth, size 10¼ x 13⅝. Mail this coupon at once to

G. & C. MERRIAM CO.
SPRINGFIELD, MASS.
Sole Publishers of GENUINE Webster Dictionaries for over 68 Years

Home Office (Coupon)
G. & C. MERRIAM CO., Springfield, Mass.:
Please send me, free of all obligation of expense, a copy of "Test in Pronunciation," and also "Red Facsimile Booklet," with special terms of your SCIENTIFIC AMERICAN free Atlas offer on the enlarged edition of "Webster's NEW International Dictionary."
Name.....
Address.....

The Scientific American Cyclopedia of Formulas
Edited by ALBERT A. HOPKINS
SIZE 6½x8¾ INCHES. 1077 PAGES. 200 ILLUSTRATIONS
CLOTH, $5.00. HALF MOROCCO, $6.50 POSTPAID

¶ This valuable work, which is partly based on the twenty-eighth edition of "The Scientific American Cyclopedia of Receipts, Notes and Queries," contains a collection of about 15,000 selected formulas, covering nearly every branch of the useful arts and industries. Never before has such a large collection of valuable formulas, useful to everyone, been offered to the public.



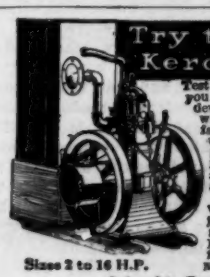
¶ This work may be regarded as the product of the studies and practical experience of the ablest chemists and workers in all parts of the world, the information given being of the highest value, condensed in concise form convenient for ready use. Almost every inquiry that can be thought of relating to formulas used in the various manufacturing industries, will here be found answered.

¶ The formulas are classified and arranged into chapters of related subjects, while a complete index, made by professional librarians, renders it easy to find any formula desired.

¶ Those engaged in any branch of industry will probably find in this volume much that is of practical use in their respective callings. Those in search of salable articles, which can be manufactured on a small scale, will find hundreds of most excellent suggestions. It should find a place in every laboratory, factory and home.

An eight page descriptive circular and table of its contents will be furnished on application.

MUNN & CO., Inc., Publishers, 361 Broadway, New York



Try the Wonderful Columbia Kerosene Engine at our Risk

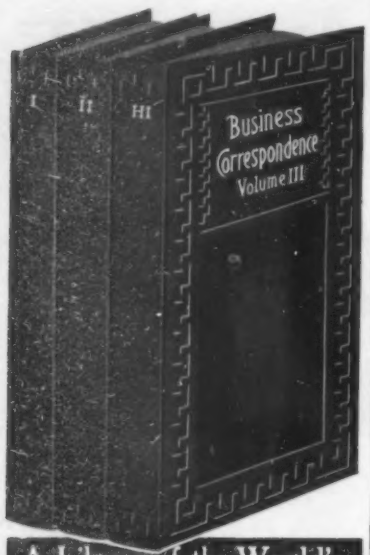
Test it out on your own place for fifteen days. Give it the hardest engine test you can think of. Compare it with any other engine. If the Columbia doesn't develop more power at less cost, send it back quick. No conditions. We are willing to let you be the judge and jury. Kerosene (common lamp oil) is by far the cheapest fuel today. The price of gasoline is climbing all the time, while kerosene remains the same, and in the right engine, it lasts longer and produces more power per gallon than gasoline. You get ALL the power when you use a Columbia, because it is the right engine. It is the one really simple and perfect kerosene engine. It never bucks when you need it most. It is always on the job.

Write for Particulars of Our Big Special Offer

We are going to double our output for next year. We can do it easily. It is just a matter of getting engine users to test the Columbia for themselves. So we are making a great special money saving offer on Columbia Kerosene Engines. This offer is liable to be withdrawn at any time, so write today for full particulars, for it is a money saver you would hate to miss. Free Book No. 96 full of engine facts you need to know, sent free.

Sizes 2 to 16 H.P.

Columbia Engine Co., 96 Fuller St., Detroit, Mich., U. S. A.



A Library of the World's Greatest Business Letters

The letters that have sold the *most* goods, collected the *most* money, settled the *hardest* complaints, won the *best* jobs, had the *strongest* influence—analyzed and dissected for *you* to learn from, to adapt to your needs, or to develop an original style of your own—with the best examples actually reproduced as they were used and graphically explained point by point.

Here in these three volumes—672 pages—are packed the success-secrets back of the letters that are actually winning the biggest results today, that are bringing orders from you and me, and making other men's fortunes.

Every striking idea found in use by mail order house, wholesaler, manufacturer, retailer, real estate or insurance man, bank, collector, individual salesman or complaint clerk was followed out and its returns studied. This mass of information, this wealth of ideas, this gold mine of absolute facts was then *charted* and *diagrammed*—and developed into one complete, yet concise library so clear and simple that from it any busy man can pick out for any sort of proposition, an idea or suggestion that he can *know* in advance to be successful; or can turn to for original inspiration.

Do you want to see actual examples of letters other men have used successfully to

- Follow-up inquiries;
- Accompany catalog;
- Appeal to women;
- Appeal to farmers;
- Appeal to merchants;
- Collect delicate claims;
- Collect installment accounts;
- Get money from dead accounts;
- Win deposits for a bank;
- Interest real estate prospects;
- Close real estate deals;
- Sell life insurance;
- Keep life insurance prospects interested;
- Get cash orders by mail;
- Settle complaints;
- Bring trade to retail store;
- Emphasize special prices;
- Offer premiums;
- Answer specific inquiries;
- Refuse credit with politeness;
- Get cash on bad debts;
- Enthuse salesmen;
- Get credit information;
- Get replies from dead prospects;
- Smooth over advance in price;
- Get results for collection agency;
- Revive old customers;
- Turn down poor credit risks;
- Satisfy ruffled customers;
- Answer complaints by good humor;
- Build up prescription business for druggist;
- Take sales advantage of current events;
- Back up salesmen;
- Interest dealers' customers;
- Clinch sale;
- Get co-operation of retail clerks;
- Offer special inducements;
- Collect retailer's accounts;
- Win attention to new realty offerings;
- Collect money before due;
- Apply for positions;
- Secure cash with order;

Special Forced Edition—$1 DOWN

$1 with this coupon brings to you transportation fully prepaid, the complete "Business Correspondence Library"—3 volumes, 672 pages, beautifully bound in T-Pattern Vellum, Blind Stamped, with titles in gold. $2 per month for 4 months thereafter—less than 7 cents a day—*pays* for them complete and, in addition, brings you SYSTEM, the Magazine of Business, every month for two full years—24 numbers of this remarkable business magazine, filled with plans and ideas.

SYSTEM stands pre-eminent the Monthly Magazine of Business—260 to 356 pages in every issue and you cannot afford to miss a single one of them. SYSTEM shows you how to conduct or how to start a business, how to win trade, minimize wastes, keep down expenses, manage men. With this coupon you receive SYSTEM every month for two years and receive at once the complete new 3-volume Business Correspondence Library. Send only $1 with the coupon.

Here at last is the clear, complete, specific method by which the business manager can make his firm's letters crackle and snap with business strength—the salesman make his letters as keen and terse as his selling talk—the young man develop himself into a power with his employers—by which banker, real estate agent, insurance man, credit man, can dictate into a letter with scientific certainty the style and character that commands. Do not risk losing your chance at this advance edition—act today.

Other men say:—

"I located within two minutes after I opened the first volume, two paragraphs that gave me ideas I can use in my business, worth many times the price."
—E. B. Davis, Sales Agent, Kansas City, Mo.

"I consider that every business office should have them for the benefit of their employes."
—F. I. Westervelt, Wholesale Lumber, 37 E. 28th Street, New York

I enclose $1. Send me at once, transportation charges fully prepaid, the complete 3-volume "Business Correspondence Library"—672 pages—bound in T-Pattern vellum, and enter my name for a full 2 years' subscription to SYSTEM, the Magazine of Business, to begin with current number. I promise to remit $2 each month for the 4 following months, making $9 in all. Sci. Am. 11-11

Name

Address

Business

City and State

46-66 E. 22nd St. NEW YORK — SYSTEM — Wabash and Madison CHICAGO

Canada price $10, same terms. Abroad $11; $5 down, $2 monthly

ELECTRIC MOTORS
Dynamos
Grinders
Polishers
SPECIAL MACHINES

ROTH ELECTRIC MOTORS
198 Loomis Street, Chicago, Ills.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A "Mars" Visitor

To the Editor of SCIENTIFIC AMERICAN:

I shall be infinitely obliged and highly thankful to you if you will kindly take on yourself the trouble to inform me at an early date as to the truth and accuracy of the following incident said to have occurred in Mexico, which has excited the amazement of the people in this quarter of the globe, especially in the absence of any mention of it in your world-renowned paper, the SCIENTIFIC AMERICAN, which I have been an interested reader of; nor do I find any such reliable authority to be referred to on the topic.

The local papers here describe the descent of a man from Mars accompanied with a clap of thunder and lightning which put all the people of the locality to flight with the single exception of a scientist, who alone had the courage to proceed to the scene of the occurrence to satisfy his curiosity, and he is said to have described the man to be twenty cubits long, his speech being above the book of the scientist. At last, the man, as is said, after a short stay, flew away. Here I request you to throw some light on the subject which will bring us from the realm of uncertainty to that of truth.

Your paper has proved very valuable to me. Almost all its articles are intrinsically interesting, opening to me a broad field of scientific knowledge. It reveals to me a museum of rare objects of curiosity and wonder. I should also thank you warmly if you would inform me through your columns how far the progress of the astronomers has, in counting stars, till now gone.

I have much to talk about and many things to converse upon, but the long distance stands in the way, as the paper (which comes to the engineering office and from which source I see it) takes a month to reach the office.

ABRAR BAKSH.

Cuttack, Bengal, India.

[The key to this extraordinary letter from our far-away correspondent will probably occur to those of our readers who may have chanced to be in the locality when "Bud" Mars, the aviator, made his recent flight into Mexico. With this incident in mind, and allowing for the errors of hearsay and translation of Mexican vernacular into Hindoo, we can see how "the local" papers came to "describe the descent of a man (from the) Mars," etc. To the Mexican countryman, who might never even have heard of, much less seen, an aeroplane, the descent out of the heavens of this apparition (with its engine back-firing and shooting out flame and thunder claps) may well have suggested the supernatural. In some such fashion, doubtless, were founded and perpetrated many of the myths of ancient Greece and Rome.—ED.]

Safety Devices in the Cab

To the Editor of SCIENTIFIC AMERICAN:

I was glad to see in your issue of October 7th the very clear and forcible statement of J. B. Wells in opposition to the proposed safety stop locomotive throttle. Two possible solutions of the problem present themselves.

What happens when a man suddenly loses consciousness from any cause? He collapses. Must we not look to this fact for our solution of the question? It is quite possible to require an engineer to perform his regular duties standing within a light, semi-circular guard. His collapse in any direction would immediately throw a considerable pressure upon the upper rail of this guard, which would result in the operation of levers shutting off the engine and applying the brakes.

Or perhaps a preferable mode of achieving the same desirable end is by a footplate upon which the engineer stands. His collapse would remove all, or in any event most, of the pressure from this plate. This is infinitely better than having the pressure at the throttle and brake valve handle, and leaves the hands of the engineer free to perform any duties he may find necessary. Any difficulties presenting themselves may, I am convinced, be met and mastered with comparative ease.

Bridgeport, Conn. ARTHUR POWELL.

The Battleship "Orion"

(Concluded from page 431.)

cent" (21.9) and the "Superb" (21.62); while the four completed battle-cruisers, designed for 25 knots, have all made well over 27 knots.

Principal interest in the new ship naturally centers in her armament. First of all as to its disposition: and here it is to be noted that the British Admiralty has been slowly working round for some years toward the consistent American principle of the all-center-line arrangement, which is, after all, as essential to the ideal dreadnought as unity of caliber. The second turret from aft, which in previous ships is on the same level as the aftermost, was raised so that the aftermost turret could be brought up under its guns. There is a general impression that the object of this arrangement was to increase the astern fire, but that is not so. The primary object was to save length; and although the special trials which the "Neptune" carried out in the Mediterranean showed that the superposed guns could be fired directly astern if needed, they also showed that such a maneuver was not at all advisable. In the case of the "Orion," no attempt has yet been made to fire more than two guns (those of the first and fifth turrets) forward or aft, nor is it likely to be.

So far as the arrangement of the turrets is concerned, the new ship has no exact counterpart in any fleet. She most nearly resembles the "Delaware" class, with, however, the following difference: In each case there are two turrets forward and three aft of the superstructure; but instead of the third turret from aft being raised above the two farther astern as in the "Delaware" class, the "Orion" has the second (or middle) turret so raised. In other words, the forward turret arrangement is repeated astern, and a fifth turret is placed just abaft of the superstructure, on the same level as the aftermost.

Each turret contains two 13.5-inch guns, of whose ballistics little is known outside the gunnery circles of the fleet itself. The weight of the gun, usually placed at 80 tons, is 76 tons, and its length is 45 calibers, while the weight of the projectile is 1,250 pounds. The muzzle energy, firing with full charges, is believed to be 69,000 or 70,000 foot-tons (as compared with 53,400 foot-tons for the latest 12-inch model in the British service); and the perforations of 26 inches of Krupp cemented steel at 3,000 and of 22 inches at 5,000 yards (with capped armor-piercing shot in each case) are believed to be reliable but must be accepted with reserve. For purposes of comparison it may be stated that the 13.5-inch guns mounted in the obsolete battleships of the "Royal Sovereign" class (now being sold out of the service) are 30 calibers in length, weigh 67 tons, and fire a 1,250-pound shell with a muzzle energy of 35,230 foot-tons, or just about half the power of the new weapon. The penetration of the old gun (Krupp steel) at 3,000 yards is 11 inches.

The following table shows the increase in the size and power of successive types of British all-big-gun ships:

Completed.	Type Ship.	Length Feet.	Tons.	Broadside, Pounds.
1906	"Dreadnought"	490	17,900	6,800
1909	"Beilerophon"	490	18,600	6,800
1910	"St. Vincent"	500	19,250	6,800
1911	"Hercules"	510	20,000	8,500
1911	"Orion"	545	22,500	12,500

The anti-torpedo armament of the "Orion" consists of twenty 4-inch 31-pounder rapid-fire guns, mounted in two groups, each of ten guns, disposed as shown in the illustrations. In the firing of the heavy guns several of the mountings of the smaller weapons were started, and so seriously that it is understood some new arrangement for them will be found.

The following sister ships to the "Orion" are approaching completion:

"Thunderer," "Conqueror," "Monarch," to be completed by March 31st, 1912. "King George V.," "Centurion," "Ajax," "Audacious," to be completed by January 16th, 1913.

The last four will be slightly larger—about 24,000 tons—due to better protec-

Earn $25.00 to $75.00 Weekly
Repairing Watches
We Teach you how.

WE WILL HELP YOU START IN BUSINESS

This is not a correspondence school. It is a big watch repairing and jewelry concern. We give you actual practice. You can stay at **home** and continue your present **occupation. You make money while you learn.**

WE GIVE INSTRUCTIONS FREE BECAUSE WE WANT YOU TO REPRESENT US.

We mean just what we say. We will furnish you, free of cost, text-books, clear, simple illustrated lessons and photo prints showing exactly how to do each job. **You will be surprised to see how easy and simple it is.** Our repair department will do the **difficult jobs** for you until you learn how—you take the **profit.**

IF YOU MEAN BUSINESS We Will Stand Back of You

We will back you to the limit. We will start you right. You will have the benefit of our advice, instruction and experience. We will supply you with materials at rock-bottom prices. Start now—as **you will need only a few dollars for tools.** You can make enough money repairing watches to **open a place of your own in a few weeks.**

Send us your name and address on a postal card, or write us, and we will send you illustrated explanation of Watch Repairing Business by return mail—**quick.**

CHAS. F. ELMORE, Principal of Watchmaking College
ROGERS, THURMAN & CO., 101-117 N. Wabash Ave., CHICAGO

The "BEST" LIGHT

Used in every civilized country on earth. Best and cheapest light for homes, stores, factories and public buildings. Makes you independent of lighting companies. Over 200 styles. Every lamp warranted. Makes and burns its own gas. 100 to 2,000 candle-power. Agents wanted. Write to-day for catalogue and prices.

THE BEST LIGHT CO.
57 East 5th Street, Canton, O.

2¢ a week — No Dirt, No Grease, No Odor

Learn Watchmaking

We teach it thoroughly in as many months as it formerly took years. Does away with tedious apprenticeship. Money earned while studying. Positions secured. Easy terms. Send for catalog.

ST. LOUIS WATCHMAKING SCHOOL, St. Louis, Mo.

RIFE RAM

Water in Quantity

all over your farm—house, field or barn—pumped without cost or trouble for you by an automatic Rife Ram. Raises water 30 feet for each foot of fall—no trouble or pumping expense. Satisfaction guaranteed. Booklet, plans, estimate, FREE.

RIFE ENGINE CO., 2582 Trinity Bldg. N.Y.

***AIR GAS!* Latest Invention**

Standard Vacuum Gas Machine makes gas automatically! Uses 97% ordinary air! Cheapest, safest, most hygienic for lighting, heating and cooking! All conveniences of city gas! Non-poisonous, non-asphyxiating, inexplosive and inodorous! Machine always ready! Gas can be made for 15c per 1000 cu. ft. 1/20 times cheaper than acetylene! Cheaper than kerosene lamps, electricity or city gas! Saving will pay for the machine in a few months! Agents wanted everywhere in the United States and abroad! Machine of 25 light capacity, $125.00.

Standard-Gillette Light Co., 10 H Michigan St., Chicago, U. S. A.

CRUDE ASBESTOS
DIRECT FROM MINES

PREPARED ASBESTOS FIBRE for Manufacturers use

R. H. MARTIN,
OFFICE, ST. PAUL BUILDING
220 B'way, New York.

STUDY LAW

High-Grade Instruction by Correspondence

Prepares for the bar. Three Courses: College, Post-Graduate and Business Law. Nineteenth year. Classes begin each month. Send for catalog giving rules for admission to the bar of the several states.

Chicago Correspondence School of Law
506 Reaper Block, Chicago

Incorporate Your PATENTS and BUSINESS in ARIZONA

Laws the most liberal. Expense the least. Hold meetings, transact business anywhere. Blanks, By-Laws and forms for making stock full-paid for cash, property or services, free. President Stoddard, FORMER SECRETARY OF ARIZONA, resident agent for many thousand companies. Reference: Any bank in Arizona.

STODDARD INCORPORATING COMPANY, Box 8000
PHOENIX, ARIZONA

SALESMEN WANTED

Trained Salesmen earn from $1,200.00 to $10,000 a year and expenses. Hundreds of good positions now open. No experience needed to get one of them. We will assist you to secure a position where you can earn good wages while you are learning Practical Salesmanship. Write today for full particulars, list of good openings, and testimonials from over a thousand men we have recently placed in good positions.

Address Nearest Office, Dept. 221
National Salesmen's Training Association
Chicago New York Kansas City Seattle New Orleans

tion for the anti-torpedo guns and possibly to the mounting of larger weapons for this purpose. Of the ships of the 1911-12 programme, for which tenders have just been asked, no details are known, but it is believed they will be similar to the "King George" class. It is probable that next year's ships will be of an entirely different type—smaller, and armed with six 15-inch and a number of 9.2-inch guns.

Simple Tests for Food Purity

(Concluded from page 432.)

harmful if it is present in large quantities. Further, nearly all the adulterants employed present a shiny appearance, whereas coffee always looks somewhat dull. A more rapid way of testing any kind of ground coffee is that pictured in an accompanying illustration. Take a tumbler of water nearly full to the brim and scatter about half a teaspoonful of the grains upon the surface of the liquid. Pure coffee contains a large amount of oil and on this account the grains will float with a very few exceptions. Practically all the adulterants in use will sink to the bottom of the tumbler. The presence of chicory in the sample is at once known by the almost instant coloring of the water a deep brown shade. If the tinting is very intense chicory has been added to a positively unwholesome extent. Pure coffee grains will not color cold water, at any rate not until the passing of a considerable interval. In these experiments it is interesting to include a few samples of the so-called coffee substitutes, many of which will be shown to contain a large amount of coffee and this in spite of the assertions of the manufacturers.

The only means by which illicit additions to tea can be detected is by an examination of the dried leaves after one has become fully acquainted with the genuine article. Leaves of many kinds of plants have been employed in this connection, of which those of the wild plum are perhaps the most commonly used. Nowadays, however, at the place of its production tea is so cheap that it scarcely will pay the manufacturer to do much in the way of adulteration. Cocoa is rather different, however, and there is little doubt that huge quantities of this substance are sadly behind what they should be in the way of quality. Some form or other of starch is a very favorite adulterant with certain sections of the trade. This may be at once detected if about a teaspoonful of the powder is placed in a cup and boiling water is added. If any starch is present the liquid shows a very marked thickening, a happening which should not be noticeable to any extent in the genuine cocoa essence. A much more harmful adulterant is the addition of cocoa shell; unfortunately the presence of this is not very easily discovered save by the help of a microscope. If the powder has been carelessly ground it may impart a slight grittiness to the mixture, though of course the skilful manufacturer will take great pains to avoid this.

There are perhaps no articles of food which are more commonly adulterated than jams and jellies. It is not an exaggeration to say that very little of the material sold of this nature is simply the fruit named on the label embodied with pure sugar. Most of the adulterants, such as those used for coloring and adding to the bulk of the jam, are fairly harmless, though none is of course desirable. Starch is a very common adulterant in jam though owing to the cloudy properties which it would give to a clear jelly it cannot be used with much effect in this article. In the case of jam it is impossible to detect its presence without a small test. Dissolve a teaspoonful of jam in half a teacupful of hot water. Through a piece of muslin strain away any solid matter which is left. Now add drop by drop a solution of potassium permanganate until the mixture is practically decolorized. In some cases of artificially colored jams the decolorization may not be very complete, but this can hardly affect the final stages of the test. When the liquid has quite cooled down add a single drop of tincture of iodine and if any starch is present the solution will turn a decided blue color. Even more commonly used than starch is glucose, and to determine the presence of this adulterant a slightly different test is necessary. Again the same quantity of jam or jelly should be dissolved in warm water; in the former instance it will be necessary to strain away the insoluble matter as before. Now allow the solution to become quite cool and then add an equal amount or possibly a little more of strong alcohol. In order that the subsequent stages may be closely observed it is as well to carry out the experiment in a glass vessel. If the sample is a pure fruit one there is very little precipitation except perhaps the smallest amount of proteid bodies. On the other hand should glucose have been employed in the manufacture a cloud of dense whiteness separates from the rest of the solution, and finally settles down at the bottom of the tumbler. This may be taken as conclusive evidence that glucose has been used as an adulterant.

In order to render the appearance of the pickles more attractive copper, to a greater or less extent, is frequently employed in the preparation of pickles. This may not have been directly added in every case, for the practice of boiling the pickles in copper jars is quite sufficient to account for its presence. Scalding vinegar has a powerful effect upon copper a fact that should be noted by every cook. Even when only present to a small extent this mineral is highly injurious as of course it is a rank poison. Pickles of a very bright green color should always be suspected and put through the following test. Mash some of the material with a fork until it is well crushed, and then place the material in a stoppered bottle. Add to this a solution composed of ammonia and water in equal parts and shake the whole well. If there should be the smallest trace of copper the ammonia turns a blue color. Copper is often used to deepen the green of imported canned goods such as peas, beans, spinach, etc. In some articles of this nature it has been found to a really alarming extent. A very interesting experiment to detect its presence is one involving the use of hydrochloric acid, a strong corrosive which of course must be used with extreme care and kept away from contact with the skin or clothes. Still the test is so curious that many people will be interested to try it. Mash a sample of the vegetables and place a teaspoonful in a teacup; add thirty drops of hydrochloric acid. Set the cup on the stove in a saucepan containing boiling water, drop a bright wire nail into the cup and keep the whole thing boiling for twenty minutes. Stir the mixture all the time with a splinter of wood. At the end of the time stated drag out the nail, when if copper has been used with the vegetables, the article will be found to be heavily plated with that metal.

A final word on the subject of canned goods may not be out of place. These are used so widely nowadays that the laws controlling their preparation are rightly stringent. Still now and again, for no very clear reason something goes wrong with a tin of goods. This is almost always shown by an alteration in the external appearance of the package. The top or the bottom appears more or less "blown out" and when this is the case even to a small extent the contents should be unhesitatingly condemned. There is always grave risk attending the consumption of articles contained in unshapely tins.

Major John Burger Waring

MAJOR JOHN BURGER WARING, brother of Col. George E. Waring, died on October 30th at the age of seventy-seven. Major Waring was well known as a pioneer steel pen maker. The two types of pens invented by him were named the Chase medallion and the Washington medallion. During the civil war he invented an improved device for spiking cannon. Enlisting as a lieutenant in the Fourth Missouri Cavalry, he attained the rank of major in the Ordnance Division. After the war he invented an apparatus for removing silk from the cocoon, also a rock drill and many other mechanical devices. All told he secured over seventy patents.

IN 1909, 65,399,889 barrels of cement were produced in the United States, valued at $52,797,973. In 1900 the production was only 17,231,150 barrels. In 1905 it was 31,675,257 barrels, in 1906 it was 51,000,445 barrels, and in 1908 it was 52,910,925 barrels.

Planning the holiday gift with a Waltham Jeweler is a mutual pleasure. The shopper delights in the beauty and design of the Waltham Watch Models. The experienced jeweler knows the inward perfection of Waltham construction.

WALTHAM
WATCH

For over three generations Waltham has stood for the highest expression of the Watchmaker's art. High grade Waltham movements—up to the Premier Maximus at $250, the watch *de luxe* of the world—are invariably named, and offer models of exquisite design and workmanship, combined with timekeeping qualities of unrivalled accuracy. *Riverside*, for instance, guarantees a consistent high grade watch in all popular sizes, men's or women's. Ask your Jeweler.

Handsome booklet describing various Waltham movements and full of valuable watch lore, free on request.
"It's Time You Owned a Waltham."

WALTHAM WATCH COMPANY, - - Waltham, Mass.

¶ An Easily Made High Frequency Apparatus

CAN BE USED TO OBTAIN EITHER D'ARSONVAL OR OUDIN CURRENTS. A plunge battery of six cells, a two-inch spark induction coil, a pair of one-pint Leyden jars, and an inductance coil, and all the apparatus required, most of which can be made at home. Supplement No. 1618. Order from your newsdealer or from *Munn & Co., Inc., 361 Broadway, N. Y.*

Your Family—

If your family is worth the best you can give in house and food and clothes, is it not worth the best reading as well?

Subscribe now—to-day—and get all the issues for the remaining weeks of 1911 Free. The Subscription Price now is only $1.75; on January 1, 1912, it will be advanced to $2.00.

The Youth's Companion

The Contents of the 52 Issues for 1912 if published in book form would equal

7 Vols Serial Stories, the kind you wish never would end, each selling for $1.50 in book form.
2 Vols Articles by Famous Men and Women. Travel, Science, Invention, Biography.
3 Vols Current Events, The Doctor's Weekly Counsel, Science, Wit and Humor, Editorials, etc.
2 Vols For Boys on Expert Training for Athletic Sports—Football, Sprinting, Swimming, etc.
8 Vols Each containing some thirty complete stories—Adventure, Heroism, Humor.
2 Vols For Girls and the Household, Ideas in Dress, The Family Table, Profitable Occupations.

And not less than 6 other Volumes of good reading, including One-Minute Stories, Talks to Girls, Anecdotes, the Children's Page, etc. Full Prospectus for 1912 sent Free to any address with Sample Copies of the Paper.

The Free Issues
HOW TO GET THEM

Every New Subscriber who at once cuts out and sends this slip (or mentions this paper) with $1.75 for The Companion for 1912 receives FREE
All the issues for the remaining weeks of 1911, including the beautiful Holiday Numbers; also BD 127
The Companion's Calendar for 1912, lithographed in ten colors and gold.
Then The Companion for the 52 weeks of 1912. Your last chance to get The Companion for $1.75. Subscribe to-day.

THE YOUTH'S COMPANION
BOSTON, MASS.

Before Subscribing

for your periodicals, you should see our Catalog, containing a list of 3000 magazines and club offers, at prices that will surprise you.

It is the handsomest and most complete Magazine Guide ever published, filled with all the latest and best club offers at rates, lower than you think possible. **YOU** cannot afford to be without it. In ordering your magazines, be sure you use a **HANSON** catalog. Accept no substitute. The name **HANSON** stands for promptness and reliability in the magazine field. It is so accepted by all leading publishers.

THIS CATALOG FOR 1912 is FREE for the asking. It will

SAVE YOU MONEY

Send us your name and address today. We'll do the rest.

J. M. HANSON MAGAZINE AGENCY

240 Hanson Block, Lexington, Ky.

FILL IN THIS COUPON AND MAIL TO US

J. M. HANSON, Lexington, Ky.

Please send me FREE of expense to me, this Catalog for 1912.

NAME .....

Street Address or County

..... *State* .....

JUST PUBLISHED *A New and Authoritative Book*

MONOPLANES and BIPLANES

THEIR DESIGN, CONSTRUCTION & OPERATION

The Application of Aerodynamic Theory, with a Complete Description and Comparison of the Notable Types

By **GROVER CLEVELAND LOENING, B.Sc., A.M., C.E.**

CRITICISMS

"The first treatise upon aviation which we have seen which may be styled really complete. . . . . Actual aeroplane designing is the central theme of the volume. . . . . The prominent types are exhaustively compared. . . . . The illustrations are a notable feature."
—*Rochester, N. Y., Chronicle.*

"A very complete account of the theory of heavier than air flying machines with a technical description of nearly all the present types of aeroplanes. . . . . Presents in compact shape the substance of aerodynamic theory. . . . . Easily comprehensible to the reader who can concentrate his attention. . . . . It is the most scientific popular book on the aeroplane that we have come across so far."
—*New York Sun.*

"Many writers have failed to realize the demand which exists for aero literature in which mathematical deductions are a necessary but not predominant part of a comprehensive exposition of the entire subject. For a writer to steer a straight course between the mazes of trigonometry on the one hand, and the superficialities of mere discussion in a popular vein on the other is to accomplish what can be done only by one who is himself a thorough student in the finer details, but who can sufficiently divorce himself from the mathematical atmosphere as to present the whole subject from a broad standpoint, making it readily intelligible and informative to the less erudite seeker after knowledge."
—*Phila. Inquirer.*

"Students learned in aerodynamics and laymen ordinarily interested in aviation will find equal delight in reading 'Monoplanes and Biplanes.' The book is a welcome addition to the libraries of those who have realized the future of aerial navigation, and desire a work treating solely of the heavier than air machines written by an acknowledged expert and with no hobbies hidden in the discussion."
—*Boston Journal.*

"While enthusiastic in his interest as becomes one who has written so superb a volume, Mr. Loening is also rigidly accurate as the most exacting scientist could demand. Here is a work which is at once a history and textbook which may be depended upon for everything that is within the range of actual knowledge. To say that 'Monoplanes and Biplanes' is at once new and authoritative with reference to the entire subject and that it is practical in the highest degree is the just praise due to this volume."—*Buffalo News.*

"Mr. Loening has written, in fact, for the man who wishes to apply practically the experience that has already been gained."
—*New York Times.*

12mo. (6x8¼ inches) 340 Pages, 278 Illustrations. Attractively bound in cloth.

Price $2.50 net, postpaid

An illustrated descriptive circular will be sent free on application.

MUNN & CO., *Inc.*, Publishers
361 Broadway New York

The test of a magazine's merit

is that its readers tell their friends about it.

We recently asked our subscribers to send us the names of those whom they believed the Scientific American would interest, and we are gratified to find that so many of our subscribers believe that its merits will appeal to such a large number of their friends. Have you sent a list? If not,

Here is the way:

Simply send us the names and addresses of the people whom you think will be interested and we will do the rest. An accurate record of all names received in this manner will be kept, and for each new subscription we get from any list we will extend the subscription of the person who sent us the list for four months. Thus if we receive three new subscriptions from any one list the subscription of the person who sent us the list will be extended for a full year.

Of course you may send as many names as you wish, the greater the number of names you send the larger the number of subscriptions we will probably receive and the longer the period for which your own subscription will be renewed.

Be careful to write the names and addresses plainly and don't fail to put your own name and the address at which you are receiving the Scientific American on each list you send.

Address all lists to Circulation Department, Scientific American, 361 Broadway, New York.

WOOD DISTILLATION for manufacturing ALCOHOL and other products of the process

¶ Profits from refuse wood and sawdust are in reach of any one who will locate near a sawmill. The Scientific American Supplement files contain a series of valuable articles on this topic which are contained in the following numbers:

1610—A General Review of the Subject of utilizing wood wastes, and the uses to which the wastes may be put.

1684—The "steam" and "destructive" distillation processes, and **names the numerous products obtainable** from the complete operation.

1661—Distillation of soft wood, and gives the proportions and quantities of each product obtainable, and the various processes used.

1723 and 1724—The general subject of the **utilization of wood wastes, giving all the products** by a clear and valuable diagram showing their relations to each other, and many illustrations of apparatus.

1592—The manufacture of wood alcohol by a German process which first converts sawdust and scraps to glucose and then to alcohol, leaving the residue of the wood with 75% of its heating value, and in condition to briquette without a binder.

1789—Prof. Ruttau's article on the **manufacture of wood alcohol,** a very comprehensive discussion.

1643—Dry distillation of Beech and other hardwoods comparing European and American methods, and giving the quantities of products obtained.

1335—Charcoal manufacture in Germany, with complete recovery of by-products, their description and uses.

1472—"Distillation of Pine Products" refers especially to turpentine manufacture, but covers the by-products as well, and gives information of the profitable nature of the business.

1551—Refers to acetic acid, wood spirit and acetone from distillation of wood, and gives a good description of the necessary apparatus, and particularly of the **points to be observed in operating the plant.**

1736—Production of Alcohol from Cellulose, how wood and wood products may be used.

Each number of the Supplement costs 10 cents. A set of papers containing all the articles above mentioned will be mailed for $1.20. Order from your Newsdealer or from us.

MUNN & CO., Inc., *Publishers,* 361 Broadway, New York City